U.S. Army Corps of Engineers
Water Resources Support Center
Institute for Water Resources

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Technical Report

LOCAL PUBLIC FINANCE IMPACT MODEL: USER'S GUIDE AND TECHNICAL DOCUMENTATION

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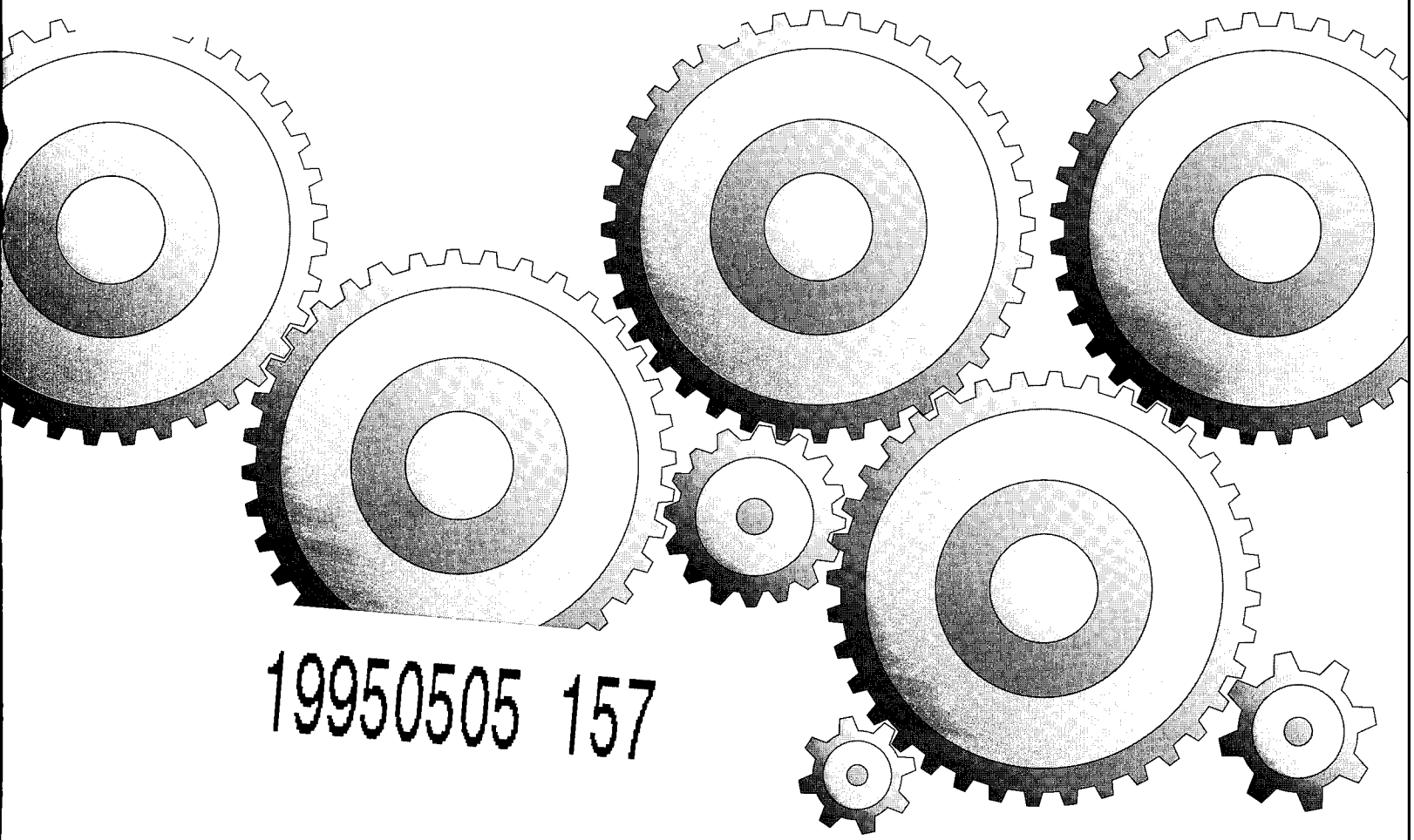

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Federal Infrastructure Strategy Program

June 1994

IWR Report 94-FIS-10

Federal Infrastructure Strategy Reports

This is the tenth in a series of interim documents published by the U.S. Army Corps of Engineers during the Federal Infrastructure Strategy program, a three-year effort to explore the development of an integrated or multi-agency Federal infrastructure policy. This report documents and describes a model known as the Local Public Finance Impact (LPFI) model which estimates the impact that a proposed infrastructure project will have on local government revenues and expenditures.

Other reports in the series thus far include:

Framing the Dialogue: Strategies, Issues and Opportunities (IWR Report 93-FIS-1);

Challenges and Opportunities for Innovation in the Public Works Infrastructure, Volumes 1 and 2, (IWR Reports 93-FIS-2 and 93-FIS-3);

Infrastructure in the 21st Century Economy: A Review of the Issues and Outline of a Study of the Impacts of Federal Infrastructure Investments (IWR Report 93-FIS-4);

Federal Public Works Infrastructure R&D: A New Perspective (IWR Report 93-FIS-5);

The Federal Role in Funding State and Local Infrastructure: Two Reports on Public Works Financing (IWR Report 93-FIS-6)

Infrastructure in the 21st Century Economy: An Interim Report - Volume 1 - The Dimensions of Public Works' Effects on Growth and Industry (IWR Report 94-FIS-7); and

Infrastructure in the 21st Century Economy: An Interim Report - Volume 2 - Three Conceptual Papers Exploring the Link Between Public Capital and Productivity (IWR Report 94-FIS-8).

Infrastructure in the 21st Century Economy: An Interim Report - Volume 3 - Data on Federal Capital Stocks and Investment Flows (IWR Report 94-FIS-9).

The program will culminate with a summary report to be published in 1994. The interim documentation contained herein is not intended to foreclose or preclude the program's final conclusions and recommendations. Within this context, comments are welcome on any of these reports.

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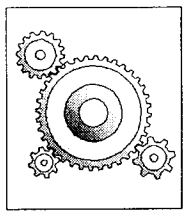
Reports may be ordered by writing (above address) or calling Ms. Arlene Nurthen, IWR Publications, at (703) 355-3042.



The Federal Infrastructure Strategy Program

Technical Report Series

Local Public Finance Impact Model: User's Guide and Technical Documentation

Dennis P. Robinson, Ph.D.

and

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Institute for Water Resources
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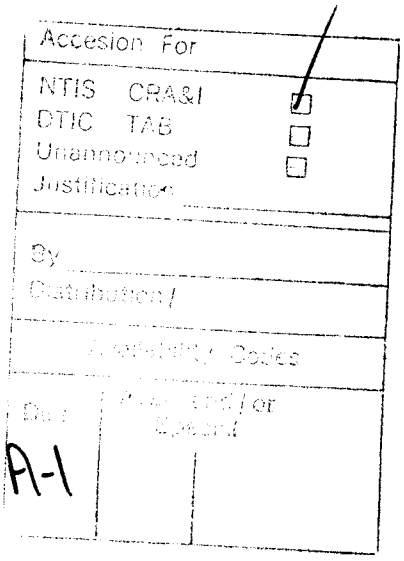

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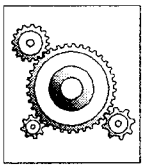


TABLE OF CONTENTS

ACKNOWLEDGEMENTS v

1. OVERVIEW AND EXECUTIVE SUMMARY 1

2. FISCAL IMPACT ANALYSIS AND THE LOCAL PUBLIC FINANCE IMPACT MODEL 3
   INTRODUCTION 3
   WHAT IS THE LOCAL PUBLIC FINANCE IMPACT MODEL 3
   WHY IS IT CALLED "PUBLIC FINANCE" IMPACT MODEL 3
   WHAT DOES THE LPFI MODEL DO? 4
   WHAT THE LPFI MODEL DOES NOT DO 5
   WHO SHOULD USE THE LPFI MODEL? 5
   HOW IS THE LPFI ESTIMATED? 6
   ASSUMPTIONS AND LIMITATIONS OF THE LPFI MODEL 6

3. A USER'S GUIDE FOR THE LOCAL PUBLIC FINANCE IMPACT MODEL . . . 7
   PLATFORM AND ACCESS. 7
   INVOKING LPFI 8
   RUNNING LPFI 8
   OTHER USES OF THE LPFI MODEL 15

4. CASE STUDIES USING THE EIFS/LPFI MODEL 19
   CASE 1: CONSTRUCTING A FLOOD CONTROL PROJECT IN SOUTHERN ILLINOIS 19
   CASE 2: STAFF REDUCTION WITH SUBSTITUTE CONTRACT IN LOS ANGELES 21
   CASE 3: NEW CORPS OF ENGINEERS OFFICE IN LOS ANGELES 23
   CASE 4: REUSE FUNCTION FOR CHANUTE AIR FORCE BASE 25

5. CURRENT FISCAL IMPACT ANALYSIS PROCEDURES 27
   TRADITIONAL FISCAL IMPACT ANALYSIS 27
   RECENT FISCAL IMPACT MODELS 30
   EVALUATION OF CURRENT FISCAL IMPACT ANALYSIS METHODS 32

6. TECHNICAL DOCUMENTATION FOR THE LOCAL PUBLIC FINANCE IMPACT MODEL . . . 33
BASIC LOCAL PUBLIC FINANCE IMPACT MODEL . . . 33
LOCAL GOVERNMENT REVENUES . . . 34
LOCAL GOVERNMENT EXPENDITURES . . . 35
FACTORS AFFECTING EXPENDITURE AND REVENUE DECISIONS . . . 37
EMPIRICAL ESTIMATION . . . 38
EVALUATING THE LPFI MODEL PERFORMANCE . . . 44

APPENDIX A - REGION OF INFLUENCE DEFINTION . . . 57

APPENDIX B - VARIABLE AND DATA SOURCES USED IN THE LPFI MODEL . 63

APPENDIX C - DEFINITIONS OF GOVERNMENT FINANCE DATA . . . 65

APPENDIX D - TSP PROGRAM AND STATISTICAL RUNS FOR THE LPFI MODEL . . . 73

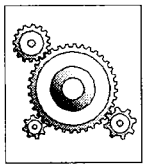
REFERENCES . . . 109

LIST OF FIGURES

Figure 1 Defining a Region in EIFS and LPFI . . . 10
Figure 2 Finding the EIFS Forecast Models for Use with LPFI . . . 11
Figure 3 Running the Construction EIFS Forecast Model . . . 14
Figure 4 Running the Standard EIFS Forecast Model for Use with LPFI . . . 16
Figure 5 EIFS/LPFI Model Impact Analysis Construction Project in Southern Illinois . . 20
Figure 6 EIFS/LPFI Model Impact Analysis Staff Reduction With Substitute Contract in Los Angeles . . . 22
Figure 7 EIFS/LPFI Model Impact Analysis New Corps Office in Los Angeles . . . 24
Figure 8 EIFS/LPFI Model Impact Analysis Reuse Function for Chanute Air Force Base . . . 26
Figure 9 Generic EIFS Impact Forecast Model . . . 46

LIST OF TABLES

Table 1 Classification of Traditional FIA Methods . . . 28
Table 2 Estimated Revenue Equations . . . 41
Table 3 Estimated Expenditure Equations . . . 42
Table 4 Mean Absolute Percentage Error Analysis: Total United States Per Capita Local Government Revenues and Expenditures . . . 48
Table 5 MAPE Analysis by State: Per Capita Revenues and Expenditures . . . 49
Table 6 MAPE Analysis by BEA Area: Per Capita Revenues and Expenditures . . . 50
Table 7 Mean Absolute Percentage Error Analysis by Metro/Non-Metro Areas Per Capita Revenues and Expenditures . . . 54

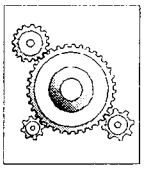


ACKNOWLEDGEMENTS

The Local Public Finance Impact (LPFI) Model is a working prototype of a system which can used by public managers to predict the potential changes in local revenues and expenditures caused by public infrastructure investments. The principal investigators for the effort and principal authors of this document were Dr. Dennis P. Robinson of the Navigation Division of IWR and Dr. Harry H. Kelejian of the University of Maryland at College Park. Both investigators worked out of the Navigation Division of IWR, headed by Dr. Lloyd G. Antle.

The prototype was developed as a component of the Corps of Engineers Federal Infrastructure Strategy (FIS) Program. The FIS program is managed by the Institute for Water Resources (IWR) under the direction of Mr. Kyle Schilling, Director of the Institute. The LPFI study component was managed by Dr. Cameron Gordon, Economics Study Manager who also edited the final report and wrote much of Chapters 3 and 4. The director of the overall FIS program is Mr. Robert Pietrowsky.

Special thanks goes to Mr. Kim M. Bloomquist (Chief of the Economics Branch) of the U.S. Army Engineer District at Chicago for the summary of the current fiscal impact practices (conventional and models). Special thanks also goes to Mr. Ronald D. Webster at the U.S. Army Construction Engineering Research Laboratory (USA-CERL) for the use of the Economic Impact Forecast System and its databases.



LOCAL PUBLIC FINANCE IMPACT MODEL: USER'S GUIDE AND TECHNICAL DOCUMENTATION

1. OVERVIEW AND EXECUTIVE SUMMARY

This report documents the development and implementation of a model to estimate the effects on local public revenue and expenditures which would be expected to stem from the construction and operation of an infrastructure facility (such as a lock and dam or a highway). To accomplish this purpose reliably, and to be of the most use to the relevant audience of local decisionmakers, the model was specified to have certain characteristics. The model was to be locally focused, i.e., estimate revenue and expenditure impacts at the county level. The model was to account for the inter-jurisdictional benefit spillover effects, namely the revenue and expenditure effects resulting from the public facilities in one jurisdiction being used by residents in other, nearby or adjacent communities. The model was to be implemented in conjunction with an existing regional economic impact model. The model would have to be generic enough to be used in conjunction with a variety of regional economic impact models (such as economic base, input-output, and econometric). Finally, the model would have to be relatively easy to use and accessible to a wide range of users.

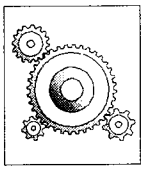
With these objectives in place, the Local Public Finance Impact (LPFI) model prototype has been developed. It is a fully operational model which, as currently configured, does estimate county-level public revenue and expenditure impacts in a way that accounts for inter-jurisdictional benefit spillover effects. The prototype is currently integrated into a broader impact forecasting model known as the Economic Impact Forecasting System (EIFS) which is currently available for use on the OSIRIS computer system at the U.S. Army Construction Engineering Research Laboratory (USA-CERL) located at Champaign-Urbana, Illinois via a computer modem using an 800-number dial-in access. While the LPFI prototype is presently a module added in to EIFS, it is generic enough to be used with most, if not all, regional economic impact models available at the time of this writing.

This report summarizes the LPFI model, its general characteristics, and its use. The report includes specific user instructions for the access and use of the EIFS/LPFI model combination. Four hypothetical case studies are provided. The traditional or conventional methods of computing fiscal (i.e., revenue and expenditure) impacts by planners are reviewed, and several available, competing fiscal impact models are discussed and evaluated. Finally, the report provides technical documentation concerning the LPFI model's logic, econometric structure, statistical estimation methodology, and performance evaluation.

This research effort also assessed the predictive performance of the model. When the LPFI and EIFS models are run to produce estimates of revenues and expenditures for past time periods and those estimates are then compared with the actual historical record, the EIFS model revenue predictions are about 100 percent (%) higher in comparison to the historic record than those of the LFPI model and the expenditure impacts are about one-third higher. This conclusion seems to hold regardless of the perspective that one uses to compare the resultant revenue and expenditure predictions (i.e., by state, by BEA economic area, or by metro or non-metro area).

This model is a prototype and as such further development is desirable to make the fruits of this effort more widely disseminated and used. On the modelling side, given the interrelationship between LFPI and EIFS, and given that LPFI appears to significantly improve forecasts of public revenue and expenditure changes caused by infrastructure investments, a more complete integration of LPFI into EIFS is warranted. In addition, the predictive performance of LPFI should be assessed against other regional economic impact models, such as econometric and input-output structures to evaluate its overall "robustness".

As for the user interface, it is recommended that a PC-compatible "stand-alone" version of LPFI be developed since PC platforms are generally more accessible than the mainframe platform on which EIFS currently resides. In addition, more comprehensive user documentation covering the use of LPFI in conjunction with other forecast models and providing more details on running the model and interpreting its results should also be developed. "Beta-testing" of both the model and its documentation would be useful, particularly as part of an undergraduate or graduate class in public finance. Such a more refined model would find broad use within the Corps. There is also a need for this model to be included in agency training courses, with perhaps a course specifically devoted to LPFI use itself.



2. FISCAL IMPACT ANALYSIS AND THE LOCAL PUBLIC FINANCE IMPACT MODEL

INTRODUCTION

Infrastructure projects generate many effects through their construction and operations. They require the employment of workers, who are paid, and with new workers often migrating and bringing their families due to the employment opportunities, etc. Along with these effects, these projects are also expected to alter the needs for local public services and, as a consequence, to changes the requirements for revenues in order to pay for the new levels of services. These broad revenue and expenditure effects are important in the initial stages of planning, when program managers are making initial budget allocations. It would be useful to have an analytic tool to aid in this process. The LPFI model was developed to estimate these types of local public revenue and expenditure impacts of infrastructure developments.

WHAT IS THE LOCAL PUBLIC FINANCE IMPACT MODEL?

The Local Public Finance Impact (LPFI) model is a set of empirical equations that, when used in conjunction with an existing regional economic impact model (such as an input-output model), will estimate the local government revenue and expenditure effects which stem from a proposed project or action. Regional economic impact models are tools used by economists, regional analysts, and other professionals to estimate the consequences of projects, programs, actions, and policies (in terms of their associated income, employment, business sales, population effects), usually within communities surrounding the projects or parts of the country that are most directly affected by the programs, actions, or policies.

WHY IS IT CALLED "PUBLIC FINANCE" IMPACT MODEL?

"Public Finance" in this context is used to refer to the finances -- revenues and expenditures -- of public entities -- local governments -- and the way in which those finances are affected by infrastructure investments. Public finance as used here does not refer to financing requirements for a project (e.g., how much a project costs or what methods are used to raise the necessary funds); the LPFI model is not intended to generate, and cannot generate, this information which must be provided by the user.

WHAT DOES THE LPFI MODEL DO?

The LPFI model estimates the local government revenue and expenditure consequences of a change in the economic and demographic character of a local economy. The LPFI model estimates impact estimates for five (5) categories of revenue:

- Federal transfers
- State and local transfers
- Local taxes
- Charges and miscellaneous revenues
- Utility, liquor store, and insurance trust revenues;

and ten (10) categories of expenditures:

- Education expenditures
- Health and hospital expenditures
- Transportation expenditures
- Police protection and corrections expenditures
- Fire protection expenditures
- Natural resources, parks, and recreation expenditures
- Public welfare, housing, and community development expenditures
- Sewerage and sanitation expenditures
- Government finance, administration, and general expenditures plus interest on the debt
- Utility, liquor store, and insurance trust expenditures

These categories correspond to the major categories used in collecting data for the Census of Governments collected by the U.S. Bureau of the Census. These categories indicate the types of revenues and expenditures collected by State and local governments. Of course, in some areas, some of these categories do not apply. For example, only some States operate public liquor stores and only these States would raise any liquor store revenues.

All categories of revenues and expenditures are computed in per capita terms, except tax revenues (which are computed relative to local personal income) and education expenditures (which are computed on a per student basis).

WHAT THE LPFI MODEL DOES NOT DO

As mentioned in a previous section, the LPFI model does not estimate how much a project is going to cost; the financial requirements necessary to implement a project must be estimated and provided by the user of the LPFI model as an input.

What the LPFI does do is estimate how a project, once paid for, will affect revenues and expenditures of the community's government. This output is important for many reasons, not least because many proposed projects are implemented on the grounds of future revenue streams; for example, sports stadiums, gambling facilities, or tax incentives to attract business establishments are often sold to the public on the grounds of future employment opportunities and revenue sources. However, often there is little evaluation of or even reflection on the reality of the these prospects. The LPFI model is meant to help fill this gap.

WHO SHOULD USE THE LPFI MODEL?

It is not required that a potential user of the LPFI model be a subject matter expert either in regional economic impact analysis or in fiscal analysis. A user of the LPFI model is expected, however, to have a basic familiarity with both regional economic impact models and local public finance (fiscal) analysis.

Fiscal impact analysis (FIA), as used in this report, is simply a procedure or set of procedures for determining whether a proposed infrastructure development in a community will generate sufficient revenues to offset the associated expenditures. FIA is not a new concept. Planners have used the technique for more than forty years to evaluate the local fiscal effects of public housing, urban renewal programs, and the suburbanization movement, to name a but a few applications (Mace, 1961). More recently, FIA has been used to assess the revenue and expenditure impacts of redeveloping older suburbs (Listokin and Beaton, 1983), developments adjacent to a major transportation corridor (Office of Economic Policy, 1986), and large-scale defense projects (Lienesch, Ambargis, and Kort, 1987).

It should be noted that fiscal analysis is a broad study of the direct and indirect effects that a project will have on a community's public revenues and expenditures. Thus it is more wide-ranging than an investment analysis which tends to focus solely on the effectiveness of investment mechanisms, such as borrowing versus tax finance, in financing a given project.

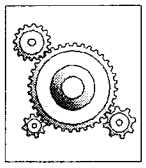
There are several excellent sources for regional economic impacts analysis: for example, see Hoover (1975), Nourse (1968), Richardson (1979), and Treyz (1993). Aronson and Hilley (1986), Beaton (1983), Prudhomme (1986), and Rosen (1986) provide coverage of the major issues concerning local public finance. Burchell, Listoken, and Dolphin (1985) demonstrate practical suggestions for computing fiscal impacts. Wildasin (1986) explains the many of the theoretical concepts used by public finance analysts.

HOW IS THE LPFI ESTIMATED?

The LPFI model was estimated using a cross-section of data at the county level over the entire United States (approximately 3,100 county units). This means that the LPFI model should provide reasonable revenue and expenditure impact estimates anywhere in the country.

ASSUMPTIONS AND LIMITATIONS OF THE LPFI MODEL

The LPFI model assumes that public administrators and local legislators raise revenues to provide public services in order to satisfy their constituents' demands for those public services. It is also assumed that local revenue and expenditure decisions are determined by what public officials think their constituents want. The levels of public services and revenues that public officials expect that their constituents want is determined by a number of demographic, economic, and fiscal characteristics within the community, including the array of public services and revenues found in neighboring communities. Changes in any of these factors are likely to alter public officials' thoughts concerning their constituents' desires for public services and, in turn, change the levels of public expenditures and revenues. It is also presumed that the economic and demographic changes stem from the effects of a project or program in an area (for example, due to the construction of lock and dam or from the operations of a local retail or manufacturing plant).



3. A USER'S GUIDE FOR THE LOCAL PUBLIC FINANCE IMPACT MODEL

PLATFORM AND ACCESS

The LPFI model currently operates on the computer system run by the University of Illinois for the U.S. Army Construction Engineering Research Laboratory (USA-CERL) in Champaign-Urbana, Illinois. USA-CERL is the platform for a number of user applications, including an economic impact forecasting system known as the Economic Impacts Forecasting System (EIFS). EIFS is what is known as an economic base model (see chapter 5 for a definition) which estimates direct and indirect changes that ripple through the economy when a change, such as a new construction project, is introduced. EIFS also contains an extensive economic and demographic database which it uses to project future economic impacts.

LPFI is an independent module attached to the EIFS model. Thus when the user provides estimates of how much, say, a new dam will cost and how much labor and capital it will require, it is the EIFS model which provides the historic record of the economy of the region affected and which then estimates how this new investment will affect the flows of goods and services in and out of that region. The LPFI model then uses these results to estimate how the initial investment, as altered by the economic changes it induced, will affect public revenues and expenditures, broken down by the detailed categories described earlier. While LPFI does require basic economic and demographic data and estimates of spending "multipliers" which represent changes in economic flows induced by a project, it does not require EIFS to provide these data and estimates. Rather EIFS is an accessible and powerful tool well suited to developing the LPFI prototype. LPFI is completely transportable for use with other models and can even be used alone as long as the user provides some basic information beyond the requirements of the project itself.

Access to the USA-CERL computer system and to the EIFS/LPFI model is available via telephone modem or other communications link with the computer through an 800 telephone number. To use the LPFI model, the user first must register with staff of the Environmental Technical Information System (ETIS) at USA-CERL to obtain a "login" name to access the USA-CERL computer. Instructions for using the USA-CERL computer, login-registration, and an EIFS User's Manual can be acquired via telephone at 1-800-USA-CERL. The conditions and costs of obtaining a login name will vary by type of user. Because the U.S. Army Corps of Engineers has provided some funding for development of EIFS and other USA-CERL applications, Corps employees generally can obtain a login at no cost. Users outside the Corps will generally have to pay for an account. Instructions for using the EIFS program are found in the EIFS User's Manual. The instructions provided here only explain how to use the LPFI model component of EIFS.

INVOKING LPFI

Here are the steps that a new user would have to take to call up the LPFI and get it ready to run:

1. Call USA-CERL and obtain an account as described above.

2. Using a modem, dial up the CERL computer and log in, providing your log-in name and password.

3. The user will then be presented with a menu of options. Choose the menu option numbered "4" which is called "Expert". This option will get you to the system-prompt of the computer. This is analagous to turning on your PC and going straight into the DOS operating system where one usually sees a symbol like "C:\" and where instructions can then be entered. Once you have selected this option, you will be faced with a blank screen and a prompt that will appear similar to the following: "yourname/osiris/home/1>".

4. At this prompt, type the following command

[1] **~robinson/bin/LPFI *filename*<*CR*>**

This command is made up of two parts: the command and the file name. The command is the first part (*~robinson/bin/LPFI*) and the file name is the second part (***filename***). <***CR***> is the return or enter key. The command part must be typed as is shown above. The file name part can be any character or combination of characters the user cares to use. It is suggested that the user may want to consider file names that have logical or contextual meaning. For instance, the file name could be a reference to a project or a particular project scenario.

The ***filename*** is necessary in the above command because the computer operating system at USA-CERL does not have "screen-saving" capabilities. In other words, once results are generated, they will be printed on the screen all at once. While it is possible to interrupt this printing, it is not possible to review the results without running the model again. It is possible, however, to save the results to a file and then scroll through them later, either on the USA-CERL computer itself or on the user's own computer after the file has been down-loaded (that is transferred from the USE-CERL computer via the modem). Instructions on downloading files are available from CERL, or from documentation with your modem or communications package.

RUNNING LPFI

Once LPFI is invoked, the EIFS system and its interface takes over. The user operates the EIFS program just as it is described in the EIFS User's Manual. The four examples which are provided later on will provide all the user needs to know to run LPFI. As these examples show, running the model is fairly straightforward.

First Step - Defining the region: After invoking the EIFS/LPFI command, [1], above, EIFS will ask the user to define the region of influence (ROI). This will be the geographic area where most the economic, demographic, and fiscal impacts are expected to occur.

How does one decide to define the region that is the geographic setting for socioeconomic/fiscal impact analysis? For people not accustomed to carrying out regional analysis, justifying a particular study area may not be easy. Even among experienced regional analysts, delineating a study region is a thorny, but very important issue. Unfortunately, few universally accepted rules are available to help an analyst choose at study area. Thus, the regional definition for an impact analysis is usually somewhat subjective or arbitrary. See Appendix A for a number of useful suggestions for defining regions.

Defining the ROI in EIFS is accomplished in one of two ways. First, the user may simply type in one or more county names when prompted by the EIFS program. Thus if the user knows exactly which counties will be affected by a project, the county names, along with their corresponding State locations, can be typed in directly. For example, a project in New York City which affects only the borough of Manhattan will have an ROI encompassed by ***"new york, ny"***, "new york" being the county of New York, and "ny" being the State of New York. Other ways of defining regions are available on the EIFS system. For example, a user is able define a region by using any of the Metropolitan Statistical Areas (MSAs), Bureau of Economic Analysis Economic Areas (EAs), or predefined military installation regions.

The other way which the user can define a region is to pick a radius centered around a particular county. If a project will impact the City of Chicago and surrounding areas, a user can define a region by invoking the command

[2] ***radius of cook, il<CR>***

EIFS will ask the user for the distance he/she wants to use. This effectively defines a region by drawing a circle (by computer) around the location in question. If the user specifies a 50-mile radius (as specified in the example given in Figure 1), then the computer will include the Cook county and the 10 counties surrounding it as the ROI, if the user so desires (the computer gives the user the option of including or not including these surrounding counties). Finally, EIFS will allow a user to predefine a region.

Figure 1 provides a sample of the initial sequence of prompts and commands which ensue after invoking LPFI. The output presented above may not exactly match the output the user sees in in the future as the USA-CERL system continues to be improved. The bold-faced characters above indicate what the user puts in. First the ROI is entered, in this case the radius around Cook county ("radius of cook, il"). The user is then asked for the radius desired in miles. In this case, "50" is entered for 50 miles around Cook county, Illinois. 10 counties fall within this radius and the user is given the choice of including all of them. Then, when prompted for the next region, the user simply pushes their return or enter key ("<CR>"). If the user had wanted to expand the ROI to include other radii or other counties, then other county names or radii would have been specified. The computer would keep prompting the user for names and would keep accepting input from the user until a carriage return was entered.

The next message - "aggregating data..." - indicates that EIFS is collecting the necessary data for the ROI so that LPFI can do its calculations. With all of the counties chosen and data aggregated, the "multipliers" for the county list are calculated; these multipliers are estimates of the changes in spending which will take place within a region when a dollar of new spending is introduced or removed. A summary of options for displaying the output that LPFI will ultimately provide is then presented. These options are not discussed here.

Economic Impact Forecast System - Version 5.0

First county or region (type ? for help): ***radius of cook, il***

Find counties within what radius (miles)? ***50 <CR>***

Found 10 counties - add them to your list? (y/n): ***y <CR>***

Next county or region (type RETURN if done): ***<CR>***

aggregating data...

1987 multipliers are being calculated for your list (10 counties).

OUTPUT WILL BE SHOWN AS: Tables, Not-Paged, with Footnotes

You may change these by asking for "f" at the "what section/profile" prompt

Figure 1 - Defining a Region in EIFS and LPFI

Finding the EIFS forecast models: After choosing the ROI, the user is presented with presented with options for choosing the type of forecast model they want to use. These forecast models are the EIFS models which estimate economic changes induced by given types of projects. Figure 2 summarizes the prompts and commands that a user would be faced with.

What is happening here is that the user is being offered a choice of different EIFS forecast models and data. The EIFS forecast models are found in the "models" sub-menu. To get there, a user must ask for the models sub-menu when the EIFS system asks the question

[3] **EIFS v5.0 - What Section (<cr> to see list):**

at the "Main Menu" level (as is shown at the top of Figure 2). If the user wants to see a list of options, the he/she would enter a carriage return (***<CR>***) at the Main Menu level.

Note that the last message - "incomplete data for proportion of children in school" - simply indicates that data for this particular set of data, not having been provided by the user, is incomplete. It will not affect the model run and is provided simply for the user's information.

The EIFS forecast models are found in option 1 of the models sub-menu. The EIFS system will automatically list the menu for the user to see. Other model options are available to the user, however

EIFS v5.0 - What Section? (<cr> to see list): ***<CR>***

EIFS v5.0 Main Menu

Type: For Section Menu:
- d Demographic Data
- e Economic Data
- m Models
- x Additional profiles

Type: For:
- 1 EIFS messages
- 2 List of contact people
- 3 Description of the differences between v5.0 and v5.x
- 4 List of changes to FIPS lists
- 5 Help with downloading to PC's
- 6 Database Information - including upgrade schedules

- \- To select a different region
- r To review your county list
- ? For a list of valid responses
- ?? For more detailed help
- quit To exit EIFS

EIFS v5.0 - What Section? (<cr> to see list): ***m<CR>***

Models Profiles (m)

Type: For EIFS Models:
- 1 Forecast Models
- 2 AIMS (Automated Input-Output Multiplier System)
- 3 RTV (Rational Threshold Value)
- 4 Forecast Significance of Impacts

Type: For CEAS Models:
- 5 AFROI (Air Force Region of Influence) Model

- \- To return to EIFS main menu
- r To review your county list
- ? For a list of valid responses
- ?? For more detailed help
- quit To exit EIFS

by us is available for: 3 4
by county is available for: 3 4

EIFS v5.0 (m) - What profile? (<cr> to see list): ***1<CR>***

Incomplete data for proportion of children in school

Figure 2 - Finding the EIFS Forecast Models for Use with LPFI

they are not integrated with the LPFI model. If they are run, then this will cause an error in the LPFI model program. A "core dump" will occur and the user may get a call from the USA-CERL staff. If a core dump does occur, just delete the core file by typing

[4] ***rm core<CR>***

Running the EIFS forecast models: After defining the region of influence and after finding the forecast models profile within the EIFS system, the user is faced with running a forecast run. This will involve choosing a forecast model and answering a series of questions that will describe the project or action for the EIFS program.

There are five versions of the EIFS forecast models. Each version analyzes a specific impact scenario.

- Standard EIFS Forecast Model
- Construction
- Construction of On-Base Housing
- Training
- AR 5-20 Economic Effects Analysis

For most purposes, however, only two of the EIFS forecast models will be relevant.[1] One, the Standard EIFS Forecast Model is appropriate when the contemplated project is an expansion or contraction of present operations. This could mean a closure or opening of a facility or simply a scenario of continued operations. And two, the Construction EIFS Forecast Model is used when the construction of a facility is planned. This model also applies in those cases where periodic maintenance is required.

The inputs required from users include those data necessary to describe the project. Specifically users must provide:

1. year in which the analysis is conducted,
2. number of project-specific civilians workers and their average annual salary,
3. percent of workers that will migrate in or out of the region as a result of the project action,
3. total local project-specific expenditures (excluding worker wages and salaries) that support the project, and

[1]The other three models are for specific military actions and don't have general civilian application.

if military personnel are involved,

4. number of military affected and their average annual salary, and

5. percentage of military living on-post.

The system will provide default values for most of these categories if the user does not have them available.

In Figure 3, an example of a Chicago construction project is offered to demonstrate the sort of input the user must provide along with the sort of output that LPFI generates in response.

Note that the user enters a carriage return ("<CR>") to obtain the model menu. Since this is a construction project, the user enters "2", followed by a carriage return ("<CR>") to use the construction forecasting model. A name for the project is provided - "Construct a Chicago Office Building" - and, unless the user has their own price deflators, a "<CR>" will trigger the use of deflators provided by the model as a default. These values are then shown on the screen and the user is asked to input either total expenditures on the project (in areas within the ROI and outside of it) or just local expenditures. In the example above, local expenditures are chosen and estimated by the user to be $100,000,000. Default values for the percentage of those expenditures going to labor and materials and for the percentage of the construction labor force working on the project expected to migrate in from outside the ROI are all accepted by typing in a series of "<CR>"s at the appropriate prompt. Then the model prompts the user to enter another forecast model, but in this case, no new runs are desired and, the user simply types "quit" followed by a "<CR>" to get out of this menu and start the model running. Although not shown above, the user is the returned to the OS prompt, shown a message saying "FORTRAN STOP" indicating that the model run is complete and the results are ready for examination. Entering another "<CR>" and this point will leave the user free to start another run, or enter other system commands.

Note that the year in which the impact is to occur is necessary to establish the appropriate adjustment to dollar figures in the model, using such tools as consumer price indices. The average annual salary data is necessary to describe the total salary inputs to the local region which are affected. Salary is defined as gross income (which is pay before deductions for income tax, withholding, and social security tax, but does not include retirement and other benefits that are not received directly by the employee).

Special pay categories for the military personnel (such as "jump" pay, "diving" pay, or "flight" pay) and housing allowances should also be included in the salary computation. The dollar value of local expenditures is the total annual change in project-related expenditures for two categories: 1) goods and services and 2) construction labor plus construction materials. Goods and service expenditures are used in the Standard EIFS Forecast Model and construction expenditures, of course, are used in the Construction EIFS Forecast Model.

Economic Forecast Models

Forecast Models - which functional area? (<cr> to see list): ***<CR>***

Type: For:
- 1 Standard EIFS Forecast Model
- 2 Construction
- 3 Construction of On-Base Housing
- 4 Training
- 5 AR 5-20 Economic Effects Analysis

- 20 Information about the models and price deflation
- 30 Overview of system supplied variables used in the models
- 40 See and/or change values of selected variables
- 50 See list of counties with hidden BEA data affecting the models
- 90 See your county list

q or - to return to EIFS
cntrl-d to leave EIFS

Forecast Models - which functional area? (<cr> to see list): ***2<CR>***

CONSTRUCTION

Project name: ***Construct a Chicago Office Building<CR>***

Enter d to enter your own price deflators
RETURN to use the default price deflators (latest year): ***<CR>***

Default price deflators:

baseline year (ex. business volume)	(CPI - 1987)	= 100.0
output and incomes (ex b.v.)	(CPI - 1992)	= 122.8
baseline year (construction)	(ENR-const - 1987)	= 100.0
local expenditures for construction	(ENR-const - 1992)	= 113.1
output and incomes (construction)	(ENR-const - 1992)	= 113.1

If entering: total expenditures, enter 1
local expenditures, enter 2 : ***2<CR>***

Local expenditures for construction project: ***100,000,000<CR>***

Percent for labor (enter new value or <cr> to accept default): (34.2) ***<CR>***

Percent for materials (enter new value or <cr> to accept default): (57.8) ***<CR>***

Percent allowed for other: 8.00 (calculated)

Percent of construction workers expected to migrate into the area
(enter <cr> to accept default): (30.0) ***<CR>***

Forecast Models - which functional area? (<cr> to see list): ***quit<CR>***

Figure 3 - Running the Construction EIFS Forecast Model

The EIFS Forecast Models produces a number of impact estimates. The model produces the following output:

1. change in total local sales volume,
2. change in total local employment,
3. change in total local income,and
4. change in total local population.

Sales volume measures the change in local total economic activity resulting from the project. Employment measures the number of "full-time" jobs affected by the proposed action. Income is measured in two ways; "place of work" and "place of residence." "Place of work income" is the amount of income generated in the region of influence due to the action by people who work in the region. "Place of residence" income is the amount of income generated in the region of influence due to the actions of people who actually reside in the region. Population is the number of people who migrate in or out of the region as a result of the proposed project.

Just to provide an example of how the a project where only new staff is hired, rather than where new construction takes place, Figure 4 shows the user instructions and computer output which results when running the Standard EIFS Forecast Model rather than the Construction Model. The logic for interpreting Figure 4 is the same as that for interpreting Figure 3.

Viewing the LPFI/EIFS output: When finished with the EIFS/LPFI run, the user just types in the command, ***quit<CR>***, on the EIFS command line. This will disconnect the user from the EIFS program and operate the LPFI program. The user does not have to do anything but wait the second or two it takes for the LPFI program to run. The LPFI program will put its results in the file named by the user (i.e., filename). After that, users will want to download the file to their own computer and then log off the CERL mainframe. The user may also scan the results of the model run immediately by typing ***show filename*** at the prompt. This command will allow the user to see the results one screen at a time and will allow the user to scroll through them backwards and forwards. Once again, details on logging off and downloading are readily available from the documentation obtained after having opened a CERL account.

OTHER USES OF THE LPFI MODEL

The Local Public Finance Impact model can be used with a variety of regional economic impact models. These models are generally classified by type according to the methodology used to compute the the impacts; e.g., input-output, econometric, and small-area assessment.[2] Most of these models generate, as a minimum, impacts in the categories of output (or sales), employment, and income. Some regional economic impact models (especially the econometric models) also generate population, labor force, and housing impacts.

---

[2]Bolton (1985), Hoover (1975), Nourse (1968), Richardson (1979 and 1985), and Treyz (1993) provide excellent discussions of the character-istics and attributes of regional economic models.

Economic Forecast Models

Forecast Models - which functional area? (<cr> to see list): ***<CR>***

Type:	For:
1	Standard EIFS Forecast Model
2	Construction
3	Construction of On-Base Housing
4	Training
5	AR 5-20 Economic Effects Analysis
20	Information about the models and price deflation
30	Overview of system supplied variables used in the models
40	See and/or change values of selected variables
50	See list of counties with hidden BEA data affecting the models
90	See your county list

q or - to return to EIFS
cntrl-d to leave EIFS

Forecast Models - which functional area? (<cr> to see list): ***1<CR>***

STANDARD EIFS FORECAST MODEL

Project name: ***Chicago office staff<CR>***

Enter d to enter your own price deflators
RETURN to use the default price deflators (latest year): ***<CR>***

Default price deflators:

baseline year (ex. business volume)	(CPI - 1987)	= 100.0
output and incomes (ex b.v.)	(CPI - 1992)	= 122.8
baseline year (business volume)	(PPI - 1987)	= 100.0
local services and supplies	(PPI - 1992)	= 114.0
output and incomes (business volume)	(PPI - 1992)	= 114.0

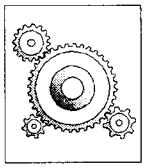
(Enter decreases as negative numbers)
If entering total expenditures, enter 1
local expenditures, enter 2 : ***2<CR>***
Change in expenditures for local services and supplies: ***1,000,000<CR>***
Change in civilian employment: ***5<CR>***
Average income of affected civilian personnel: ***100,000<CR>***
Percent expected to relocate (enter <cr> to accept default): (0.0) ***100<CR>***
Change in military employment: ***<CR>***

Forecast Models - which functional area? (<cr> to see list): ***quit<CR>***

Figure 4 - Running the Standard EIFS Forecast Model for use with LPFI

To combine the LPFI model with any of the existing regional economic impact models care must be taken to appropriately configure the impacts that go from the regional economic impact model to LPFI. Appendix B provides a list of explanatory variables that if changed will cause LPFI to estimate consequent changes in revenues and expenditures. It is important that all monetary changes should reflect price levels for 1982. Also, most regional economic impact models generate their values in terms of changes. For such models, the LPFI equations variables related to the state-specific effects (i.e., state "binary" variables) can be ignored.

The LPFI model can also be used as a "stand-alone" public finance impact model. This would be useful for simulation analysis. For example, a proposed residential development may provide for 300 single-family dwellings, for 1,000 townhouses, or for a retirement community housing 2,500 people (depending on the type of zoning applied to the development). The estimated revenue and expenditure impacts will vary significantly with these scenarios and their associated demographic and economic characteristics.



4. CASE STUDIES USING THE EIFS/LPFI MODEL

To provide more detail of the mechanics of the EIFS/LPFI model , four case studies were analyzed: a construction project in Southern Illinois; a staff reduction with a contract replacement in Los Angeles, California; opening a new Corps of Engineers office in Los Angeles; and a reuse function for Chanute Air Force Base in Illinois. The results from these case studies are shown in Figures 5 through 8 and discussed below.

CASE 1: CONSTRUCTING A FLOOD CONTROL PROJECT IN SOUTHERN ILLINOIS

The first case study (Figure 5) is that of a hypothetical proposed construction project located in an area of the southern-most part of the State of Illinois. The proposed project is the construction of a small flood control project. It is assumed that the exact size and operation of the proposed facility is not known due to the early planning phase of the project. However, the State legislature and local county officials want to know the nature of the economic and fiscal impacts that the project will place on the local communities near the proposed facility. In order to determine a reasonable estimate of these impacts, it was decided to hypothesize a $10 million construction project. In addition, the State legislature specifies that the construction funds are to be spent within the area of Jackson and Union Counties of Illinois due to historically high unemployment problems in the southern part of the State. Figure 5 shows the results of the LPFI/EIFS model run. The first part of the model output simply shows the inputs provided either by the user or the computer if a default value was used. Basic demographic and geographic information is shown for the counties which make up the ROI, in this case Jackson and Union counties in Illinois. Below that the "functional area" indicates that the option "2" - the construction model - has been employed. The project name as designated by the user is then shown, followed by the price deflators (which are indicated to be default values), the local expenditures for the project (input by the user as $10,000,000) and the percentages for labor, materials and construction workers who have migrated from outside the area (which, although not indicated as such, happen in this case to be default values as well).

Then the model output is shown. The first block of numbers is mostly output from the EIFS model. Changes in direct and indirect sales, direct employment, direct income, population, demand for housing and relocating employees which are caused by the project are estimated by EIFS and displayed here.

Also provided is a summary estimate of changes in government revenues and expenditures caused by the project. This estimate is calculated from the LPFI model and is followed by a detailed breakdown of different categories of revenue and expenditure in the data block labelled "Local Public Finance Impact Analysis." Under the "Government Revenues" heading, for example, the model indicates that the

```
You have selected 2 counties:
  #  FIPS    County                          State  '90 Population  Area(sq km)
  1 17077   jackson                             il          61,067        1,561
  2 17181   union                               il          17,619        1,093
            Total                                           78,686        2,654

ECONOMIC IMPACT FORECAST SYSTEM MODEL RUN

Functional area:  2   Project name:  Construction in Southern Illinois
Deflators:  (EIFS default deflators were used)
    (price deflator for baseline year (ex b.v.)):  100.00
    (price deflator for output (ex b.v.)):  122.80
    (price deflator for baseline year (const)):  100.00
    (price deflator for output (const)):  113.10
Local expenditures for construction project:  $10,000,000
    (price deflator):  113.10
Percent for labor:  34.20%
Percent for materials:  57.80%
Percent of construction workers expected to migrate from outside the area:  30.0%

CONSTRUCTION IMPACT FORECAST:  Construction in Southern Illinois

Change in local                                  impact    % change
Export income multiplier...............:         1.911
   Sales volume.................direct:          8530
               ................indirect:          7768
               ..................total:         16297       1.899
   Employment...................direct:           116
             ....................total:           346       0.886
   Income.......................direct:          1469
         ........total by place of work:          6521
         ...total by place of residence:          6399       0.591
   Population...........................:            85       0.107
             .......off-base population:            85
             .....number of school kids:            15
   Demand for housing...........rental:            37
                    ....owner-occupied:             0
   Government finance......expenditures:           159
                    ..........revenues:            32
                    ......net revenues:          -127
Relocating employees...........civilian:            37
                    ...........military:             0

Local Public Finance Impact Analysis

Government Revenues....................:            32
   Federal transfers...................:            -2
   State & local transfers.............:           -62
   Taxes (sales, property, & other)....:            21
   Charges & misc revenues.............:            76
   Utility revenues....................:             0
Government Expenditures................:           159
   Education...........................:             1
   Health & hospitals..................:            17
   Transportation......................:            38
   Police protection...................:             8
   Fire protection.....................:             4
   Parks & recreation..................:             8
   Welfare & housing...................:             1
   Sanitation..........................:             0
   Finance & administration............:            73
   Utility expenditures................:             5
Net Government Revenues................:          -127

Sales, income, and government finance impacts are in
thousands of dollars.  Government finance calculations
based on equations developed by Dennis P. Robinson
and Harry H. Kelejian in LOCAL FINANCE IMPACT MODEL:
DOCUMENTATION GUIDE. Fort Belvoir, VA: U.S. Army
Institute for Water Resources (November 1993).

Existing EIFS Government Finance Impacts
   expenditures......:          404
   revenues..........:          503
   net revenues......:          100
```

Figure 5 - EIFS/LPFI Model Impact Analysis Construction Project in Southern Illinois

construction project in southern Illinois will reduce revenue from Federal transfers to State and local governments by $2,000, (figures are presented in thousands of dollars), reduce State and local transfers outside the region to those inside the region by $62,000, raise sales, property and other taxes inside the region by $21,000, and raise intra-regional charges and miscellaneous revenues by $76,000, for a net gain to local governments in the region of $32,000. A similar interpretation applies to the breakdown of government expenditure numbers.

The final four lines of output show a summary of public expenditures and revenues as calculated by EIFS itself. It should be noted that these totals are different from the totals provided by LPFI and are also summary figures only, not detailed breakdowns. These figures show where EIFS ends and LPFI begins and how the two models are different. EIFS estimates the economic changes induced by the proposed project. LPFI uses this information to estimate detailed changes in government expenditures and revenues. It happens that EIFS also is capable of calculating of changes in overall government revenues and expenditures in the region, but does not do so with the same level of detail as LPFI and also provides different estimates than LPFI. An analysis in one of the appendices to this report indicates that the LPFI estimates for government finances are more accurate than those provided by EIFS.

CASE 2: STAFF REDUCTION WITH SUBSTITUTE CONTRACT IN LOS ANGELES

The second case (Figure 6) analyzed by the EIFS/LPFI model is that of an example of a firm reducing its staff size and replacing their function by a contract with another firm. This is sometimes called "out-sourcing." Under this simple scenario, an existing office employing 2,500 workers (each making $65,000 per year in salaries) is to be closed and replaced by a contract let to a local firm for $300 million.

The analysis is similar to that offered for case study 2. Only one county - Los Angeles county - is in the ROI and in this case the "functional area" chosen is "1", i.e. the Standard EIFS forecast model to analyze a change in staffing levels rather than construction of a new facility.

Since this is a staff reduction rather than a new construction project, the model output in Figure 6 are a bit different from Figure 5. Rather than local expenditures for construction, the user had to enter the change in expenditures for local services and supplies, in this case $300,000,000. The user also had to enter an estimate of the size of the reduction in civilian employment, namely 2,500 people, and their average income, $65,000. All of these inputs are shown in the first block of output labelled "ECONOMIC IMPACT FORECAST SYSTEM MODEL RUN." That output block also shows the percent of affected civilian personnel expected to relocate, in this case everyone (100%).

The next block of output labelled "STANDARD EIFS MODEL FORECAST" shows the same information as shown in Figure 5, that is changes in sales volume, employment, income, population, demand for housing, relocating employees and government finances. All but the government finances estimates are provided by EIFS. The government finances figures, both total and broken down by category, are calculated by LPFI and are provided in the block below labelled "Local Public Finance Impact Analysis."

```
You have selected 1 county:
  #  FIPS    County                                State  '90 Population  Area(sq km)
  1 06037   los angeles                                ca       8,863,164       12,309
            Total                                                8,863,164       12,309

ECONOMIC IMPACT FORECAST SYSTEM MODEL RUN

Functional area:  1   Project name:  Staff Reduction
Deflators:  (EIFS default deflators were used)
    (price deflator for baseline year (ex b.v.)):  100.00
    (price deflator for output (ex b.v.)):  122.80
    (price deflator for baseline year (BV) ):  100.00
    (price deflator for output (BV) ):  114.00
Change in expenditures for local services and supplies:  $300,000,000
    (price deflator):  114.00
Change in civilian employment:  -2500.00
Average income of affected civilian personnel:  $65,000
    (price deflator):  122.80
Percent of affected civilian personnel expected to relocate:  100.0%
Change in military employment:  0.00
Average income of affected military personnel:  $0
    (price deflator):  122.80
Percent of affected military living on-post:  0.00%

STANDARD EIFS MODEL FORECAST:  Staff Reduction

Change in local                                   impact    % change
Export income multiplier...............:          4.174
   Sales volume.................direct:         178712
               ................indirect:         567313
               ...................total:         746026       0.219
   Employment...................direct:           1061
             ....................total:           1929       0.039
   Income.......................direct:          25471
         ........total by place of work:         -56174
         ...total by place of residence:         -53011      -0.029
   Population...........................:          -7005      -0.083
             .......off-base population:          -7005
             .....number of school kids:           -985
   Demand for housing............rental:          -1295
                    ....owner-occupied:          -1205
   Government finance......expenditures:          -1714
                    ..........revenues:           1125
                    ......net revenues:           2839
Relocating employees...........civilian:          -2500
                   ...........military:              0

Local Public Finance Impact Analysis
Government Revenues....................:           1125
   Federal transfers...................:            -63
   State & local transfers.............:           2302
   Taxes (sales, property, & other)....:            -42
   Charges & misc revenues.............:           -627
   Utility revenues....................:           -442
Government Expenditures................:          -1714
   Education...........................:           -210
   Health & hospitals..................:           -219
   Transportation......................:           -270
   Police protection...................:           -145
   Fire protection.....................:            -72
   Parks & recreation..................:            -59
   Welfare & housing...................:           -329
   Sanitation..........................:            -82
   Finance & administration............:           -522
   Utility expenditures................:            198
Net Government Revenues................:           2839

Sales, income, and government finance impacts are in
thousands of dollars.  Government finance calculations
based on equations developed by Dennis P. Robinson
and Harry H. Kelejian in LOCAL FINANCE IMPACT MODEL:
DOCUMENTATION GUIDE. Fort Belvoir, VA: U.S. Army
Institute for Water Resources (November 1993).

Existing EIFS Government Finance Impacts
   expenditures......:        -8534
   revenues..........:       -14726
   net revenues......:        -6192
```

Figure 6 - EIFS/LPFI Model Impact Analysis Staff Reduction with Substitute Contract in Los Angeles

The LPFI analysis shows that a shift in civilian employment from direct employment to outsourcing with a $300,000,000 with a local firm results in a net increase in government revenues by close to $3 million ($2,839,000 to be exact). What money the local governments lose through a reduction in employment is apparently made up for by the increase in income to the local firm which gained the contract and by the reduction in expenditures necessary for local services for the now displaced workers (remember, it is assumed here that 100% - all - of the affected employees will move to other jurisdictions outside the region).

One contrast worth noting here is between the EIFS estimates of government finance impact and the LPFI estimate. In this case, while LPFI finds a net gain to the local government of close to $3 million, the EIFS model estimates a net loss of over $6 million ($6,192,000). While differences between the EIFS and LPFI models are not always this dramatic, this is an example of how the different equations embedded in LPFI can lead to results which would lead to decisions quite dissimilar to those based on EIFS results. As one of the appendices shows, preliminary analysis shows that LPFI generally is a better predictor of government finance impacts from local projects than EIFS.

CASE 3: NEW CORPS OF ENGINEERS OFFICE IN LOS ANGELES

The third case (Figure 7) is similar to the second case, except it is a scenario in which a new office opens (rather than closes). Here a new Corps of Engineers activity starts in the Los Angeles area whose purpose is to study, manage, and mitigate urban flooding problems. The new office has a staff of 2,500 economists, engineers, biologists, and other professional personnel. Their average annual salary is $65,000 (i.e., cost locality). The office has been given an annual budget for operations of $300 million, to be spent in the local community.

The basic interpretation of the output in Figure 7 can be found in the analyses of cases 1 and 2 (Figures 5 and 6). Again, what is interesting here is the difference between the EIFS estimates and the LPFI impacts, and also the distinction between the overall economic impacts of the office expansion and the more narrow effects of this expansion of local government finances. LPFI shows this $300,000,000 office expansion to have a negative impact on government finances equal to a net reduction in net revenues of $9,653,000. The EIFS model shows a net positive impact on government finances of $12,018,000.

How can a major office expansion be a bad thing? That is what the LPFI model seems to be showing. The answer is that the expansion is not a bad thing for the region in economic terms. Sales volume, employment, income, population and demand for housing all increase because of the project. These newly enriched taxpayers also earn more taxable income and this new economic activity results in increased taxable transactions, resulting in increased government revenues. However, since it is assumed that all the new employees will come from outside the region (remember, "the percent of affected civilian personnel expected to relocate" is 100%), the local government is faced with 2,500 new constituents, all of whom place new demands on the government for local services, thus pushing up expenditures on these services beyond the increase in revenues caused by the new activity. Net government revenues thus decline, or at least that is what LPFI predicts.

```
You have selected 1 county:
          #  FIPS    County                          State  '90 Population  Area(sq km)
          1 06037   los angeles                        ca       8,863,164       12,309
                    Total                                       8,863,164       12,309

        ECONOMIC IMPACT FORECAST SYSTEM MODEL RUN
        Functional area:  1   Project name:  New Office
        Deflators:  (EIFS default deflators were used)
            (price deflator for baseline year (ex b.v.)):  100.00
            (price deflator for output (ex b.v.)):  122.80
            (price deflator for baseline year (BV) ):  100.00
            (price deflator for output (BV) ):  114.00
        Change in expenditures for local services and supplies:  $300,000,000
            (price deflator):  114.00
        Change in civilian employment:  2500.00
        Average income of affected civilian personnel:  $65,000
            (price deflator):  122.80
        Percent of affected civilian personnel expected to relocate:  100.0%
        Change in military employment:  0.00
        Average income of affected military personnel:  $0
            (price deflator):  122.80
        Percent of affected military living on-post:  0.00%

        STANDARD EIFS MODEL FORECAST:  New Corps Office
        Change in local                                  impact    % change
        Export income multiplier...............:         4.174
           Sales volume.................direct:        421287
                       ................indirect:       1337354
                       ...................total:       1758642        0.516
           Employment...................direct:          2501
                      ....................total:         12941        0.263
           Income.......................direct:         60043
                 ........total by place of work:        413148
                 ...total by place of residence:        389886        0.212
           Population...........................:          7005        0.083
                     .......off-base population:          7005
                     .....number of school kids:           985
           Demand for housing............rental:          1295
                            ....owner-occupied:          1205
           Government finance......expenditures:         10043
                            ..........revenues:           390
                            ......net revenues:         -9653
        Relocating employees...........civilian:          2500
                           ...........military:             0

        Local Public Finance Impact Analysis

        Government Revenues....................:           390
           Federal transfers...................:           -65
           State & local transfers.............:         -5617
           Taxes (sales, property, & other)....:           995
           Charges & misc revenues.............:          4634
           Utility revenues....................:           443
        Government Expenditures................:         10043
           Education...........................:           262
           Health & hospitals..................:          1155
           Transportation......................:          2315
           Police protection...................:           604
           Fire protection.....................:           308
           Parks & recreation..................:           487
           Welfare & housing...................:           369
           Sanitation..........................:           106
           Finance & administration............:          4363
           Utility expenditures................:            68
        Net Government Revenues................:         -9653

        Sales, income, and government finance impacts are in
        thousands of dollars.  Government finance calculations
        based on equations developed by Dennis P. Robinson
        and Harry H. Kelejian in LOCAL FINANCE IMPACT MODEL:
        DOCUMENTATION GUIDE. Fort Belvoir, VA: U.S. Army
        Institute for Water Resources (November 1993).

        Existing EIFS Government Finance Impacts
           expenditures......:       33536
           revenues..........:       45554
           net revenues......:       12018
```

Figure 7 - EIFS/LPFI Model Impact Analysis New Corps Office in Los Angeles

CASE 4: REUSE FUNCTION FOR CHANUTE AIR FORCE BASE

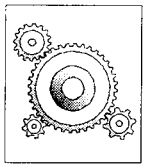
The fourth case (Figure 8) is an example of a "reuse" analysis of a proposed activity to be located at Chanute Air Force Base in Illinois. The proposed light manufacturing facility (when operating at full capacity) is expected to employ 15,000 people with an average annual salary of $45,000. In addition, the plant will require the expenditure of $100 million is services and supplies to support its operations.

The basic analysis of Figure 8 is quite similar to those for the other case studies. Unlike those case studies, this one affects 12 counties and not just one or two. Also, LPFI shows that the expansion of the Chanute Air Force Base results in a net gain in regional government revenues equal to $1,487,000, as opposed to the net gain estimate of $20,201,000 produced by EIFS.

One reason that this AFB expansion results in a net gain of income for local governments while the Los Angeles expansion did not is that only 50% of the affected personnel in this case are expected to come in from outside the region while in the Los Angeles case, 100% of those affected were predicted to migrate into the region. The local governments in Illinois were thus not as proportionately overwhelmed with new service demanders as the local governments in Los Angeles county. This example indicates how the LPFI model can be used to vary assumptions for regional projects to test the sensitivity of income and expenditure predictions to different assumptions about factors such as migration of people into and out of the area in response to a project. In this case, planners might want to see if net revenues are still positive when it is assumed that 100% of workforce expansion must come from outside the region. Of course, in- and out-migration is only one of many factors, such the characterstics of the regional economies, the costs of providing public services and tax rates, which might account for differences between the Los Angeles case study and this one.

```
You have selected 12 counties:
  #  FIPS    County                          State  '90 Population  Area(sq km)
  1 17019   champaign                          il         173,025        2,584
  2 17029   coles                              il          51,644        1,321
  3 17039   de witt                            il          16,516        1,049
  4 17041   douglas                            il          19,464        1,081
  5 17045   edgar                              il          19,595        1,617
  6 17053   ford                               il          14,275        1,260
  7 17075   iroquois                           il          30,787        2,896
  8 17113   mc lean                            il         129,180        3,073
  9 17115   macon                              il         117,206        1,516
 10 17139   moultrie                           il          13,930          892
 11 17147   piatt                              il          15,548        1,140
 12 17183   vermilion                          il          88,257        2,337
            Total                                         689,427       20,766

LCONOMIC IMPACT FORECAST SYSTEM MODEL RUN

Functional area:  1   Project name:  Chanute AFB Expansion
Deflators:  (EIFS default deflators were used)
    (price deflator for baseline year (ex b.v.)):  100.00
    (price deflator for output (ex b.v.)):  122.80
    (price deflator for baseline year (BV) ):  100.00
    (price deflator for output (BV) ):  114.00
Change in expenditures for local services and supplies:  $62,651,712 (calculated)
  Non-local value entered:  $100,000,000
    (price deflator):  114.00
Change in civilian employment:  15000.00
Average income of affected civilian personnel:  $45,000
    (price deflator):  122.80
Percent of affected civilian personnel expected to relocate:  50.0%
Change in military employment:  250.00
Average income of affected military personnel:  $60,000
    (price deflator):  122.80
Percent of affected military living on-post:  0.00%

STANDARD EIFS MODEL FORECAST:  Chanute AFB Expansion

Change in local                                  impact    % change
Export income multiplier...............:         2.678
   Sales volume.................direct:        573271
               .................indirect:        961661
               ..................total:       1534931        7.730
   Employment...................direct:          3607
              ...................total:         24907        6.776
   Income.......................direct:         54498
         ........total by place of work:        835917
         ...total by place of residence:        815103        6.846
   Population...........................:         19166        2.782
             .......off-base population:         19166
             .....number of school kids:          3174
   Demand for housing............rental:          2743
                     ....owner-occupied:          5007
   Government finance......expenditures:         31249
                     .........revenues:         32736
                     ......net revenues:          1487
Relocating employees..........civilian:          7500
                    ...........military:           250

Local Public Finance Impact Analysis

Government Revenues....................:         32736
   Federal transfers...................:          -309
   State & local transfers.............:         -8459
   Taxes (sales, property, & other)....:         31755
   Charges & misc revenues.............:          9689
   Utility revenues....................:            60
Government Expenditures................:         31249
   Education...........................:          1207
   Health & hospitals..................:          2586
   Transportation......................:          6013
   Police protection...................:          1432
   Fire protection.....................:           623
   Parks & recreation..................:          1186
   Welfare & housing...................:           918
   Sanitation..........................:           514
   Finance & administration............:         10996
   Utility expenditures................:          5770
Net Government Revenues................:          1487

Sales, income, and government finance impacts are in
thousands of dollars.  Government finance calculations
based on equations developed by Dennis P. Robinson
and Harry H. Kelejian in LOCAL FINANCE IMPACT MODEL:
DOCUMENTATION GUIDE. Fort Belvoir, VA: U.S. Army
Institute for Water Resources (November 1993).

Existing EIFS Government Finance Impacts
   expenditures......:       44510
   revenues..........:       64711
   net revenues......:       20201
```

Figure 8 - EIFS/LPFI Model Impact Analysis Reuse Function for Chanute Air Force Base



5. CURRENT FISCAL IMPACT ANALYSIS PROCEDURES[3]

Fiscal impacts are concerned with public costs and revenues. Traditionally, fiscal impact analysis has focused on the impacts of residential or nonresidential entrance into or departure from a locality. In recent years there has been considerable interest shown in the development of quantitative models for fiscal impact assessment. These models typically allow for the treatment of multiplier impacts and multi-regional (e.g., local-to-state or local-to-local) fiscal flows. The models below are described in terms of their characteristics and attributes, not in terms of what they don't do or how well they perform.

This section examines the different fiscal impact analysis (FIA) methods currently used by practioners. First, traditional methods, as exemplified by those contained in the *Fiscal Impact Handbook* by Burchell and Listokin (1978), are discussed. This reference work remains the most widely used practical guide for conducting fiscal impact studies by consultants and local planning agencies. This is followed by an overview of more recent developments in fiscal impacts modeling. Five models are reviewed including two products of the U.S. Department of Commerce's Bureau of Economic Analysis: the Regional Input-Output Modeling System (RIMS II) and the Texas Fiscal Impact Model (TFIM). Also reviewed is the Virginia Impact Projection (VIP) Model (Johnson and Keeling, 1987), a model developed by the New Jersey Office of Economic Policy to analyze the impact of economic growth on the budgets of municipal and state governments in New Jersey (Office of Economic Policy, 1986), and a model (called EIFS) developed by the U.S. Army Construction Engineering Research Laboratory to analyze the regional economic, demographic, and fiscal impacts of military realignment actions (Huppertz and Bloomquist, 1992).

TRADITIONAL FISCAL IMPACT ANALYSIS

Burchell and Listokin (1978) outline six (6) alternative procedures for estimating the local revenue and expenditure impacts of new developments. These are: Per Capita Multiplier, Service Standard, Proportional Valuation, Case Study, Comparable City, and Employment Anticipation.[4] All six techniques are similar in two respects. First, they may be described as single-region methods. That is, each approach examines the revenue and expenditure effects of a project on a single community in isolation. No attempt to model project-induced transfers of funds between a municipality and the state or among municipalities is made. A second characteristic common to all six methods is their lack of treatment of multiplier impacts. The reason cited for not including multiplier effects is that they are too difficult to identify and model (Burchell, Listokin, and Dolphin, 1985, p. 3). This view seems to ignore the

[3]The section is largely based on a discussion by Kim Bloomquist (1988).

[4]For a detailed description of these methods see Burchell, Listokin, and Dolphin (1985).

tremendous amount of research in economic base and input-output methods that has occurred during the last three decades.[5] Moreover, others have pointed out the potential importance of secondary (or multiplier) fiscal effects on a community (Muller, 1975, p. 28).

The traditional or conventional methods described by Burchell and Listokin (1978) differ in what kinds of fiscal impacts they measure and how they measure them. Several of the methods are specialized in the measurement of fiscal impacts of residential developments, others in the analysis of nonresidential projects. Furthermore, the approach used in measuring impacts varies; some of the methods use average costing while others adopt a marginal costing approach. The table below displays the classification of these six techniques according to application and approach.

TABLE 1
Classification of Traditional FIA Methods

	Application	
Approach	**Residential**	**Nonresidential**
Average Costing	Per Capita Multiplier Service Standard	Proportional Valuation
Marginal Costing	Comparable City Case Study	Employment Anticipation Case Study

Of the four methods applicable for use with residential developments, the most commonly used technique is the Per Capita Multiplier method. This procedure is the least expensive to implement and inputs may be readily obtained from existing secondary sources. The Case Study method is the most expensive in terms of time and effort required, although it provides the greatest amount of detail. The Service Standard method requires less information to implement than the Case Study method, but more than Per Capita Multiplier, especially if local standards are used. The Comparable City technique requires about the same amount of information as the Service Standard method and is less often used due to the necessary assumption that growth in one city will emulate the pattern and timing of growth in other cities.

The Proportion Valuation method is the most frequently used approach for analysis of nonresidential fiscal impacts. Again, the primary reasons are simplicity and use of available secondary data for inputs. The Employment Anticipation method, described in detail in Listokin and Beaton (1983), has only been estimated for a small sample of communities in New Jersey. It does require more information than Proportional Valuation and is calibrated using econometric techniques. Finally, the Case Study approach may also be used for nonresidential projects.

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[5]See Richardson (1985), for example, for a comprehensive review of this research.

Both average and marginal costing techniques may be used to project local government expenditures resulting from growth. The principal difference is that average costing assumes this relationship is linear while marginal costing allows for economies of scale and other factors which may influence the cost of providing municipal services. Generally, average costing methods are less expensive to implement. On the other hand, marginal costing techniques, while requiring greater expenditure of time and effort in data collection, should be used when there is significant excess or deficient capacity in the system of municipal services being provided. In the long run, however, the two techniques will produce similar estimates of growth impacts.

In the following subsections, two of the six traditional methods--per capita multiplier and proportional valuation--are described in greater detail. The remaining four techniques are used for less often by practitioners. Readers wishing information on the other methods should consult Burchell and Listokin (1978).

Per Capita Multiplier Method: The Per Capita Multiplier (PCM) method is a general approach for estimating the fiscal impacts of residential developments. Revenues and expenditures associated with a proposed development are estimated separately and compared to determine net impacts. Local revenues are grouped into four categories: (1) revenues associated with real property (property tax); (2) revenues associated with income (typically local income, sales, and utility taxes); (3) per capita, per pupil, or other per "population unit" revenues (e.g., state and federal education revenues); and (4) miscellaneous revenues (fees, user charges, licenses, etc.). Expenditures are classified as either operating or capital expenditures. Operating expenditures are further subdivided into education--typically the largest outlay--and noneducational services.

The PCM approach uses existing expenditure and revenue relationships to project future impacts. The underlying assumption is that current service quality, tax structure, and tax rates are to be maintained. Municipal operating expenditures are estimated by multiplying current average expenditures per capita by the project-induced change in population. New capital costs are allocated between new and existing developments. Property tax revenues are derived by applying the property tax rate to the assessed valuation of the new development. Sales tax revenues are determined by projecting retail sales and applying the tax rate. The change in local income tax revenue is calculated using the tax rate times the change in personal income. The change in state and federal aid for education is usually estimated using the number of new school-age children expected to reside in the development with the appropriate school-aid formula. Finally, miscellaneous revenues are calculated using per capita rates.

Proportional Valuation Method: The Proportional Valuation (PV) method is an average costing approach used to estimate the impact of nonresidential (industrial and commercial) developments on local costs and revenues. A two-stage process is used to assign a share of municipal costs to new nonresidential uses. First, the proportion of total municipal costs for nonresidential activities is determined. The assumption usually is made that relative real property values represent shares of municipal costs. An alternative is to use the ratio of employment to the sum of population and employment as a means of allocating municipal expenditures to business (Isard and Coughlin, 1957). The second step is to allocate a portion of these nonresidential costs to the new facility. Again, this is typically accomplished using proportional property value to employment relationships. Municipal revenues stemming from the establishment of a new commercial enterprise are estimated using the same procedure as in PCM.

Empirical studies have shown that the direct proportional assignment of municipal costs tends to greatly understate or overstate actual outlays. Thus, "refinement coefficients" have been introduced as a means of overcoming this deficiency (Burchell and Listokin, 1978). Selecting appropriate refinement coefficients imposes an additional problem for the analyst since such coefficients are likely to vary by geographic area and government unit. Therefore, the analyst may have to contend with less accurate estimates of fiscal impacts unless a substantial effort is made to collect this additional information. If this is seen as desirable, then one might simply conduct a full Case Study analysis.

RECENT FISCAL IMPACT MODELS

In recent years there has been considerable interest shown in the development of quantitative models for fiscal impact assessment. Unlike traditional or conventional fiscal impact analysis methods, these models typically allow for treatment of multiplier impacts and multiregional (e.g., local-to-state or local-to-local) revenue flows. At the same time, however, these models rely on more sophisticated estimation procedures, require a greater number of inputs, and are significantly more complex, thereby making them less understandable to the non-technician. Five of these models are only briefly described here.[6] One model, the Economic Impact Forecast System (EIFS) Forecast Impact Model, will be used for comparative purposes later in this report.

Regional Input-Output Modeling System: In the early 1980's, the U.S. Bureau of Economic Analysis (BEA) developed the Regional Input-Output Modeling System (RIMS II) (BEA, 1981). RIMS II is used to estimate the regional economic impacts (e.g., changes in output, employment, and income) for a specific activity, such as a new manufacturing plant.

Recently, the U.S. Bureau of Economic Analysis (BEA) expanded its RIMS II program to include a fiscal impact component (Beemiller, 1987). The fiscal component to the RIMS II model makes projections for local government revenues and expenditures likely to occur in response to the socioeconomic impacts associated with a project. The expenditure impacts are estimated using linear regression techniques on cross-section data. The impacts on tax revenues (sales, personal income, and property) are estimated by applying the local tax rate to the change in the tax base. The impacts on federal and state transfer payments, other taxes, and user charges are based on the population changes induced by a project. Projections are made at the county level for study regions consisting of up to five counties and a planning horizon of up to seven years specified by the user.

Texas Fiscal Impact Model: The Texas Fiscal Impact Model (TFIM) was also developed by BEA to specifically examine state and local fiscal impacts of large-scale defense projects (Kort, Lienesch, and Ambargis, 1987). TFIM was developed specifically to examine the state and local fiscal impacts of large-scale defense projects (e.g., home-porting). Unlike RIMS II which is estimated using cross-section data, TFIM uses time-series equations to project state and local government revenues (7 categories) and expenditures (12 categories). The time-series data for the fiscal variables come from the Bureau of the Census', *Government Finances* for intercensal years and *Census of Governments* for census years.

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[6]The purpose here is to note the existence and characteristics of other models, not to provide detailed explanations of how each model works. More detailed discussion of these models are given by Bloomquist (1988).

TFIM is linked to both the RIMS II and NRIES II (National-Regional Impact Evaluation System) models.[7] RIMS II is used to determine the multiplier impacts of an initial change in local economic activity and NREIS II supplies forecasts of future economic and demographic variables which are used as explanatory variables in the fiscal model. This configuration facilitates analysis of interregional and intertemporal fiscal impacts.

Virginia Impact Projection Model: The Virginia Impact Projection (VIP) Model was developed by the Virginia Polytechnic Institute and State University (Johnson and Keeling, 1987). VIP is an econometrically estimated model based on cross-section data for the 96 counties and 45 cities of Virginia. Projections are made for eleven expenditure variables and nine revenue variables, with an emphasis on non-local aid revenue sources. Demographic variables such as labor force, population and public school enrollment also are projected.

The VIP model allows for a wide range of impact scenarios ranging from a change in the local fire protection rating through a change in the median level of education of the population. Separate versions of VIP are available for cities and counties. The decision to offer two separate models was made after empirical evidence for scale economies in the provision of services was noted (Johnson and Keeling, 1987). Thus, the model would seem to be well-suited for estimation of impacts at different spatial levels.

New Jersey Office of Economic Policy Model: The New Jersey Office of Economic Policy recently developed a fiscal impact model to assess the impact of growth along several major transportation corridors in that state (Office of Economic Policy, 1986). The purpose of the model is to determine whether municipal and state governments will realize a fiscal surplus or deficit from anticipated growth in these areas. This application is concerned with identifying the fiscal impacts associated with land use changes.

Instead of attempting to forecast impacts on individual categories of expenditures and revenues as is done in RIMS II, TFIM, and VIP, the New Jersey model only estimates total impact. While this may reduce the amount of information available to the analysts, this approach also reduces the inputs needed to operationalize the model.

Economic Impact Forecast System Forecast Impact Model: The Economic Impact Forecast System (EIFS) is a computer based economic modeling and information system developed by economists and analysts at the U.S. Army Construction Engineering Research Laboratory which supports regional economic impact analyses by planners analysts within the military and by non-military economists and social scientists. EIFS provides its users with analytical capabilities for assessing the magnitude and significance of potential socioeconomic impacts of proposed actions or projects within any county or multi-county area of the United States. The EIFS impact model contains a two-equation, local area public finance model. One equation each for expenditures and revenues.

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[7]For a complete discussion of how RIMS II and NREIS II are linked, see Kort, Cartwright, and Beemiller (1986).

EVALUATION OF CURRENT FISCAL IMPACT ANALYSIS METHODS

Several of the procedures and models discussed above have very attractive features. The conventional or traditional fiscal impact analysis methods exhibit the virtues of low cost of implementation, greater understandability by non-economists, and current widespread application by local planners. However, they are at best measures of fiscal change, perhaps only useful for ranking project alternatives according to relative impact (i.e., project A is likely to produce greater net fiscal benefits that project B, and B greater than C, and so forth). The traditional methods have normally omitted consideration of multiplier impacts as well as multi-jurisdictional fiscal flows. The omission of multiplier effects may lead to significant undercounting of the total fiscal impacts of a project. Finally, projects that may affect both residential and nonresidential land users--such as flood control--would require the use of two separate techniques (PCM and PV, for example) to estimate fiscal impacts. PCM, by itself, is not suited for analysis of nonresidential developments because population change is used to drive the model and there is often no direct link between a nonresidential development and population change. For example, the additional jobs resulting from the creation of an industrial park may be filled by unemployed local residents.

In addition to being large and complex models, both TFIM and RIMS II rely on in-house BEA models and databases (e.g., NRIES II) for inputs. Furthermore, TFIM is estimated using time-series data which is scarce at the sub-state level. Both the Virginia Impact Projection Model and the New Jersey Office of Economic Policy Model are specifically designed for the idiosyncratic characteristics of their individual state economies and governmental systems. Adapting either of these models to more general application would require substantial investment of time and resources. The Economic Impact Forecast System offered the option of a generally available system for most planners and economists that is low cost, that does not require substantial amount of input data, and that estimates the multiplier aspects of fiscal impact analysis.

In the local public finance literature, there have been a number of theoretical studies that assume the that fiscal benefits "spill over" from one area to another.[8] These "spill overs" stem can from several sources. For example, it is reasonable that residents and public officials in one community know of types and levels of public services provided in nearby or surrounding communities. Well established public finance notion indicates that administrators and other public officials, who are responsible for making local revenue and expenditure decisions, are influenced by the decisions of their counterparts in other jurisdictions, especially in communities that are nearby or that may be competitive in terms of their locational advantages or disadvantages for businesses and residents. In addition, people from surrounding communities often use the public services (such as parks, hospitals, libraries, police and fire services, etc.) that are provided by a single jurisdiction. Highways in one jurisdiction may benefit the residents of a neighboring area that travel over those roads. The effects of excellent education institutions in one region can spill over into other regions as people move and influence the variety and amounts of public services provided to residents. None of the existing readily available fiscal impact analysis methods account for these geographic interactions.

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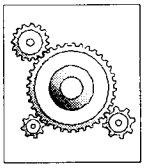
[8]See, for example, Williams (1966), Brainard and Dolbear (1967), Pauly (1970), Arnott and Grieson (1981), and Gordon (1983).



6. TECHNICAL DOCUMENTATION FOR THE LOCAL PUBLIC FINANCE IMPACT MODEL

Recently, Case, Hines, and Rosen (1991) implemented a model of fiscal benefit spillovers which explicitly modelled the fiscal policy interdependence between states. Kelejian and Robinson (1993) investigated a model of fiscal policy interdependence of county police expenditures. The following model of local government revenues and expenditures build on the theoretical and empirical developments of Kelejian and Robinson (1993).

BASIC LOCAL PUBLIC FINANCE IMPACT MODEL

As a point of departure, we assume that people in the position of making decisions regarding the provision of and payment for the public services approach their public decision making responsibilities in an honest and forthright manner. That is, we believe that administrators and public officials try to provide the types and amounts of public services (i.e., roads, schools, hospitals, etc.) that they think their constituents want. Similarly, it is our opinion that the officials will attempt to fashion the funding strategies (i.e., bonds, taxes, etc.) necessary to pay for those services in ways that are satisfactory to their constituents (or at least, the methods that they will put up with).

In general, investments in public services normally take several years to bear fruit (schools, streets, and other facilities take time to construct and begin operations). Therefore, public officials are left with making these expenditure decisions today when the implementation of those services will not be complete until sometime later. That is, officials attempt to determine their constituents' desires today for levels of services that will occur in the future.

In addition, we assume that the decision makers are familiar and make comparisons with the types and levels of public services provided in nearby or surrounding communities. Further, we assume that this familiarity and these comparisons somehow affect the decisions concerning the types and levels of services that local public officials provide to their constituents. Similarly, we expect that public administrators and local legislators will raise revenues to provide public services, based on what the administrators and legislators think their constituents want and in comparison with the revenue burdens of neighboring areas.

We think that the above considerations will tend to make public officials "risk averse" to changes in decisions regarding funding requirements (i.e., taxes and other revenue enhancements) and expenditure levels. Also, we feel that this conservatism will cause a certain amount of inertia in the system so that adjustments over time in their funding requirements and level of expenditures will tend to be sluggish. In other words, if a local official perceives a need for more school or highway capacity, he/she will be

reluctant to embark on a major construction program with out careful consideration of his/her constituents' desires.

The public officials's predictions of his/her constituents' desired levels of revenue and expenditures are determined by what the officials know of their constituents' needs and tastes. It is reasonable to assume that the officials will determine these needs and tastes through a knowledge of their community's demographic, economic, and financial characteristics. Age and racial composition, educational attainment, income and employment opportunities, preponderance of poverty, housing preferences, and local fiscal conditions would all pay important roles in molding a public official's predictions of their constituents' needs and demands for revenues and expenditures.

The Local Public Finance Impact model is predicated on the notion that changes in the factors that affect the public officials' estimates of their constituents' demand for public services or need for revenues and that changes in their neighbors' provision of public services and revenue levels will change the levels of a community's expenditures and revenues. The following two sections generically discuss the revenue and expenditure equations of the LPFI model. The next three sections present the factors that affect expenditure revenue decisions and the empirical estimation of the model and a discussion of the model's result. Finally, a discussion of the LPFI model's performance in comparison with that of the EIFS model is presented.

LOCAL GOVERNMENT REVENUES

If $\mathbf{R}_{it}$ is per capita public revenues in area **i** at time **t** for some category of interest (e.g., transfers, miscellaneous charges, etc.), then we can model the above type of behavior with the following equation;

$$(\mathbf{R}_{it} - \mathbf{R}_{it-1}) = \alpha_r(\mathbf{R}^d_{it} - \mathbf{R}_{it-1}) + \rho_{r1}\,\bar{\mathbf{R}}^n_{it} + \rho_{r2}\,\bar{\mathbf{R}}^n_{it-1} + \mathbf{v}_{it} \qquad [1a]$$

where,

$\mathbf{R}^d_{it}$ is the level of per capita revenues that are predicted by local legislators and public administrators in locality **i** at time **t-1** to be tolerated by their constituents during time **t**.

$\bar{\mathbf{R}}^n_{it}$ is the average per capita revenues of area **i's** neighbors at time **t**.**i** indicates the locality.

t, t-1 are time periods (respectfully, current and previous periods).

α_r, ρ_r's are parameters.

$\mathbf{v}_{it}$ is the error term in the model (administrators and legislators do not always have perfect foresight, nor are they always able to perfectly implement their programs).

The adjustment parameter, α_r, corresponding to past level of public revenues and the perception of the level of tolerance for revenues that public officials think their constituents want in the future is analogous to the "capital stock adjustment" mechanism of investment theory found in macroeconomics.[9] α_r indicates the amount of the difference between present revenue levels and public officials' perceptions of voters' tolerance for future revenues which will be eliminated during a given period). It seems intuitive that α_r is positive but less than one (i.e., $\mathbf{0 < \alpha_r < 1}$).

[9]The capital stock adjustment principle is explained by James Gapinski (1982, pp. 177-182).

$\mathbf{R}^{n}_{it}$ and $\bar{\mathbf{R}}^{n}_{it-1}$ are both considered in equation [1a] to account for the possibility of both contemporaneous and lagged response feedbacks vis-a-vis neighboring localities (ρ_{r1} and ρ_{r2}). If changes in public revenue decisions are "very" sluggish then this suggests that ρ_{r1} is zero. We also expect that $|\rho_{r1}| < 1$ and $|\rho_{r2}| < 1$ because of spatial stability issues.[10]

Local public officials' perceptions in time **t-1** of their voters' desired revenue levels in time **t** are formed based on what the local administrators and legislators know about their communities in time **t-1**; for example, we assume that

$$\mathbf{R}^{d}_{it} = \mathbf{X}_{rit-1}\,\mathbf{B}_{r}, \qquad [2a]$$

where $\mathbf{X}_{rit-1}$ is a vector of variables (or set of information) for area **i** in time **t-1** that influence the predictions by legislators of constituents's tolerance for public revenues, and $\mathbf{B}_{r}$ is a vector of parameters that contain the weights that legislators place on the variables.[11]

As it is configured above, our model (equations [1a] and [2a]) can not be directly estimated. However, if [2a] is substituted into [1a] and then the terms are rearranged, we get

$$\mathbf{R}_{it} = (1-\alpha_{r})\mathbf{R}_{it-1} + \mathbf{X}_{rit-1}(\alpha_{r}\mathbf{B}_{r}) + \rho_{r1}\bar{\mathbf{R}}^{n}_{it} + \rho_{r2}\,\bar{\mathbf{R}}^{n}_{it-1} + \mathbf{v}_{it}. \qquad [3a]$$

Because $0 < \alpha_{r} < 1$, the coefficient of the lagged revenue variable, $\mathbf{R}_{it-1}$, in [3a], namely $1-\alpha_{r}$, is clearly between zero and one: $0 < 1-\alpha_{r} < 1$.

Equation [3a] is specified for five (5) categories of revenue sources.

- Federal transfers
- State and local transfers
- Local taxes
- Charges and miscellaneous revenues
- Utility, liquor store, and insurance trust revenues

All revenue data were expressed in per capita terms with the exception of local taxes. Local taxes were estimated in terms of tax rates (i.e., relative to local personal income). See Appendix C for the definition of the revenue variables.

LOCAL GOVERNMENT EXPENDITURES

If $\mathbf{E}_{it}$ is per capita public expenditures in area **i** at time **t** for some category of interest (e.g., police, education, administration, etc.), then we can model the above type of behavior with the following equation;

$$(\mathbf{E}_{it} - \mathbf{E}_{it-1}) = \alpha_{e}(\mathbf{E}^{d}_{it} - \mathbf{E}_{it-1}) + \rho_{e1}\,\bar{\mathbf{E}}^{n}_{it} + \rho_{e2}\,\bar{\mathbf{E}}^{n}_{it-1} + \mathbf{u}_{it} \qquad [1b]$$

---

[10]Spatial stability issues are discussed by Robert Haining (1990, pp. 66-69).

[11]The vector $\mathbf{X}_{rit-1}$ is likely to contain a similar set of explanatory variables as is contained in $\mathbf{X}_{eit-1}$ (defined above).

where,

$\mathbf{E}^{d}_{it}$ is the level of per capita expenditures that are predicted by local legislators and public administrators in locality **i** at time **t-1** to be desired by their constituents during time **t**.

$\bar{\mathbf{E}}^{n}_{it}$ is the average per capita expenditure of area **i's** neighbors at time **t**.

i indicates the locality.

t, t-1 are time periods (respectfully, current and previous periods).

α_e, ρ_e**'s** are parameters.

$\mathbf{u}_{it}$ is the error term in the model (administrators and legislators do not always have perfect foresight, nor are they always able to perfectly implement their programs).

The adjustment parameter, α_e, corresponds to past level of public expenditures and the perception of the level of the expenditures that public officials think their constituents will desire in the future. Here, α_e indicates the amount of the difference between present expenditures and public officials' perceptions of voters' desires for future expenditures which will be eliminated during a given period). It seems intuitive that α_e is positive but less than one (i.e., $\mathbf{0} < \alpha_e < \mathbf{1}$).

$\bar{\mathbf{E}}^{n}_{it}$ and $\bar{\mathbf{E}}^{n}_{it-1}$ are both considered in equation [1b] to account for the possibility of both contemporaneous and lagged response feedbacks vis-a-vis neighboring localities (ρ_{e1} and ρ_{e2}). If changes in public expenditure decisions are "very" sluggish then this suggests that ρ_{e1} is zero. Again, we also expect that $|\rho_{e1}| < 1$ and $|\rho_{e2}| < 1$ because of spatial stability issues.

Local public officials' perceptions in time **t-1** of their voters' desired expenditure levels in time **t** are formed based on what the administrators and legislators know about their communities in time **t-1**; for example, we assume that

$$\mathbf{E}^{d}_{it} = \mathbf{X}_{eit-1}\,\mathbf{B}_e, \qquad [2b]$$

where $\mathbf{X}_{eit-1}$ is a vector of variables (or set of information) for area **i** in time **t-1** that influence the predictions by legislators of constituents's desires for public expenditures, and $\mathbf{B}_e$ is a vector of parameters that contain the weights that legislators place on the variables.

As it is configured above, our model (equations [1b] and [2b]) can not be directly estimated. However, if [2b] is substituted into [1b] and then the terms are rearranged, we get

$$\mathbf{E}_{it} = (\mathbf{1}-\alpha_e)\mathbf{E}_{it-1} + \mathbf{X}_{eit-1}(\alpha_e\mathbf{B}_e) + \rho_{e1}\,\bar{\mathbf{E}}^{n}_{it} + \rho_{e2}\,\bar{\mathbf{E}}^{n}_{it-1} + \mathbf{u}_{it}. \qquad [3b]$$

Because $\mathbf{0} < \alpha_e < \mathbf{1}$, the coefficient of the lagged expenditure variable, $\mathbf{E}_{it-1}$, in [3b], namely $\mathbf{1}-\alpha_e$, is clearly between zero and one: $\mathbf{0} < \mathbf{1}-\alpha_e < \mathbf{1}$.

Equation [3b] is specified for ten (10) categories of expenditures.

- Education expenditures
- Health and hospital expenditures

- Transportation expenditures
- Police protection and corrections expenditures
- Fire protection expenditures
- Natural resources, parks, and recreation expenditures
- Public welfare, housing, and community development expenditures
- Sewerage and sanitation expenditures
- Government finance, administration, and general expenditures plus interest on the debt
- Utility, liquor store, and insurance trust expenditures

All expenditure data are expressed in per capita terms with the exception of education expenditures. Education expenditures are expressed in per student terms. See Appendix C for the definition of the expenditure variables.

FACTORS AFFECTING EXPENDITURE AND REVENUE DECISIONS

The vectors containing the factors that influence the predictions by local administrators' and legislators' presumptions concerning the tolerances for revenues and the desires for expenditures (i.e., $\mathbf{X}_{rit-1}$ and $\mathbf{X}_{eit-1}$, respectively) was taken to be a variety of demographic, economic, and financial variables for counties in the United States. These data include,[12]

Demographic variables:

- Population
- Median age of population
- Percent of population that is school-aged: 3-18
- Percent of population over age 60
- Percent of population that is black
- Percent of population that is white
- Percent of population that finished high school
- Percent of population that ever attended college
- Percent of population over age 15 that are divorced or separated
- Percent of population living in urban area
- Population density

Economic variables:

- Income per capita
- Median housing value
- Percent of population living in rental housing
- Percent of housing that is vacant
- Unemployment rate
- Percent of working-aged population unemployed 15 weeks or more

[12]See Appendix B for definitions and sources.

- Percent of families with no workers
- Percent of families below the poverty level with children aged 6-17

Financial variables:

- Federal transfers per capita
- State and local transfers per capita
- Local taxes as a percent of personal income
- Total local revenues

Generally, the same set of demographic and economic variables were contained in both the $\mathbf{X}_{rit-1}$ and the $\mathbf{X}_{cit-1}$ vectors. These variables were included to measure the respective communities' tolerances of local revenues and desires for local expenditures, on which the local officials base their predictions. The vector for revenues, $\mathbf{X}_{rit-1}$, contained the financial variables for transfers (federal, state, and local) and local taxes rates. The vector for expenditures, $\mathbf{X}_{cit-1}$, contained the financial variables for total local revenues.

EMPIRICAL ESTIMATION

Sample and Data: Counties are used as the unit of observation because they constitute a convenient aggregate of local governments. In total, there are 3,092 counties in the country where data for all of the dependent and explanatory variables are available. The time periods of the analysis covered 1982 and 1987 (the latest two reported Censuses of Governments). All monetary values are deflated to the base year of 1982 using the personal consumption expenditure (PCE) deflator from the U.S. Bureau of Economic Analysis (BEA).

The dependent variables for the estimated equations were,

Revenue Variables	Expenditure Variables	
FEDERAL XFERS	EDUCATION	PARKS & REC
STATE XFERS	HLTH & HOSP	WELFARE & HOUS
TAX RATE	TRANSPORT	SANITATION
CHG & MISC	POLICE PROT	FIN & ADM
UTILITY	FIRE PROT	UTILITY

Each estimated equation contained one or more of the explanatory variables listed below.

LAG DEP	YOUNG	RENTP
M CUR DEP	OLD	VACANT
M LAG DEP	BLACK	UNEMP
FED TRN	WHITE	HARD
S&L TRN	HIGH	IDLE
TAX RATE	COLLEGE	POVERTY
INPP82	DIVORCE	URBAN
POP82	HVAL	DENSITY
MEDAGE		

The **LAG DEP**, **M CUR DEP**, and **M LAG DEP** variables are, respectively, the lagged dependent variable (for 1982), the neighbors' current average value of the dependent variable (for 1987), and the neighbors' lagged average value of the dependent variable (for 1982). In addition to the explanatory variables given above, a set of state-specific "dummy" variables was used in each estimated equation to determine significant state-level differences in the estimated revenue and expenditure relationships.

An interesting feature of this model is the explicit consideration of the revenue and expenditure decisions in one area being influenced by the revenue and expenditure decisions of neighboring communities. For the purposes of estimation, the neighbors of one county are defined to be any counties whose population centers are within fifty (50) miles of the subject county.

Estimation Procedures: The theoretical basis and an explanation of the procedures used to estimate equations [3a] and [3b] for each of the revenue source and expenditure categories are provided by Kelejian and Robinson (1993).

The logic of the model is that the revenue and expenditure decisions in each area are partly determined by the revenue and expenditure decisions in neighboring areas. Generally, it was assumed that neighbors' current average level of revenues or expenditures (the variable **M CUR DEP**) would be a significant explanatory variable for each estimated equation. If so, then a variable such as $\bar{\mathbf{R}}_{it}^{n}$ in equation [3a] or $\bar{\mathbf{E}}_{it}^{n}$ in equation [3b] must be determined by the dependent variable, namely $\mathbf{R}_{it}$ and $\mathbf{E}_{it}$ (respectively). The reason being, that the $\mathbf{i}^{th}$ area is itself a neighbor to its neighboring areas. This implies that equations [3a] and [3b] can not be consistently estimated by ordinary least squares (OLS) procedures. Consequently, a two-stage least squares (2SLS) procedure was used to estimate each equation. The considered set of instrumental variables for each estimated equation contained corresponding neighbors' average value for each of the explanatory variables used in the estimated equation plus an additional common set of variables. The additional common set of variables included the neighbors' average values for the following variables:

INPP82	**COLLEGE**	**UNEMP**
MEDAGE	**MARRIAGE**	**FLABOR**
YOUNG	**DIVORCE**	**POVERTY**
OLD	**VACANT**	**HARD**
TEENT	**RENTP**	**IDLE**
BLACK	**HVAL**	**URBAN**
WHITE	**RVAL**	**DENSITY**
HIGH		

If the coefficient of the **M CUR DEP** (i.e., ρ_{r1} or ρ_{e1}) was not significantly different from zero (i.e., by examining their estimated t-values), then the **M CUR DEP** variable was dropped as an explanatory variable and the equation was re-estimated using OLS procedures. **Discussion of Model Results:** Equations [3a] and [3b] were estimated for each of the for five revenue sources and the ten expenditure categories described above. The results of the estimation process (described above) for the

revenue and expenditure categories are shown in Tables 2 and 3.[13] For the sake of brevity, detailed discussion of each equation will not be undertaken here. What follows is a discussion of several of interesting comparisons and contrasts between the equations.

The first feature of the estimated equations is the consideration of the "sluggishness" parameter. That is, the significance and value of the estimated coefficients of the **M CUR DEP** variable (i.e., ρ_{r1} or ρ_{e1}). It was noted above that if local public revenue and expenditure decision makers were "sluggish," then these coefficients should not be statistically significant different from zero. This was the case for all sources of revenues, except for tax rates, and for six categories of expenditures (expenditures for police protection, fire protection, welfare and housing, sanitation, finance and administration, and utilities). Interestingly, the other categories of revenues and expenditures, which have estimated values of ρ_{r1} and ρ_{e1} that are significantly different from zero, are ones for which there tends to be inter-jurisdictional competition and rivalry (for tax rates and expenditures for education, health and hospitals, transportation, and parks and recreation). It is very common, for example, to see a community's low tax rates or its superior educational and recreational facilities advertised in newspapers and other media.

The second feature of this model is the explicit consideration of the revenue and expenditure decisions in one area being influenced by the revenue and expenditure decisions of neighboring communities. This spatial feedback affect is measured by the effects of the revenue and expenditure decisions in neighboring communities (i.e., through the coefficients ρ_{r1}, ρ_{r2}, ρ_{e1}, and ρ_{e2}). Decisions on tax rates and on expenditures for education, health and hospitals, transportation, police protection, and parks and recreation appear to exhibit significant spatial feedback effects. In no case were any of the estimated spatial feedback effects greater than one or less than minus one.[14]

Third, across the equations for all revenue sources and for all expenditure categories, the estimated coefficients for the lagged dependent variables (i.e., $\mathbf{1}\text{-}\alpha_r$ and $\mathbf{1}\text{-}\alpha_e$) positive, less than one, and statistically significant different from zero. This means, as was expected above, that the estimated "stock adjustment" parameters (i.e., α_r**'s** and α_e**'s**) are positive and less than one. This means that local public officials will try to eliminate the difference between present revenues and expenditures and their perceptions of their voters' desires for future revenues and expenditures.

Overall, the equations appear to reasonably capture the behavior of local public officials with regard to the revenue and expenditure decisions. Comparing the differences between the actual 1987 per capita revenue and expenditure levels and those predicted by the model, the equations are able to explain from 40 to 83 percent (%) of the variance in the revenue levels and from 31 to 79 percent of the expenditure levels throughout the entire country (using $\mathbf{R}^2$ adjusted for degrees of freedom as a measure

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[13]The results in Tables 2 and 3 do not include the coefficients for the state dummy variables and their standard errors or their t-values. Complete estimation results (including for the state dummy variables) and the Time Series Processor (TSP) program that generated the results are provided in Appendix D.

[14]This is a stability condition than has been noted by many researchers in the spatial econometrics literature; see, for example, Robert Haining (1990, pp. 66-69) for a discussion of spatial stability issues.

Table 2 - Estimated Revenue Equations

	FEDERAL XFERS	STATE XFERS	TAX RATE	CHG & MISC	UTILITY
CONSTANT	257.130	47.5548	0.040114	33.9676	6.75692
	12.658	1.758	.213	.825	.384
LAG DEP	0.218828	0.762232	0.932507	0.683134	1.11229
	11.033	63.128	80.543	34.489	116.837
M CUR DEP			0.812972		
			7.892		
M LAG DEP			-0.791579		
			7.662		
FED TRN		0.080109			
		2.358			
S&L TRN	0.039043				
	5.615				
TAX RATE				11.8446	
				5.306	
INPP82		-0.00980252	0.0000469499	0.011338	
		8.683	4.108	4.008	
POP82		-0.0000262861			
		3.249			
MEDAGE					
YOUNG					
OLD					
BLACK	-2.69038				
	14.086				
WHITE	-2.81313	0.511605	-0.00382454	-1.65582	
	16.369	2.989	2.218	4.715	
HIGH	0.429361			1.25399	
	3.243			2.118	
COLLEGE					
DIVORCE					
HVAL					
RENTP					
VACANT					
UNEMP	1.43007				
	3.455				
HARD		0.894487			
		3.805			
IDLE					
POVERTY		1.13978			
		4.712			
URBAN					
DENSITY	0.00874207	0.023165			.025166
	6.229	8.668			7.132
METHOD	OLS	OLS	2SLS(IV)	OLS	OLS
OBS	3087	3091	3092	3092	3041
STD ERR	51.506	89.138	1.028	208.279	143.662
R-SQU	.471	.836	.835	.413	.837
ADJ R-SQU	.461	.832	.832	.403	.834
F-STAT	47.241	265.538	277.926	38.888	295.221

Table 3 - Estimated Expenditure Equations

	EDUCATION	HLTH & HOSP	TRANSPORT	POLICE PROT	FIRE PROT
CONSTANT	182.892	-25.0694	-65.8246	21.4768	-24.9393
	3.085	1.339	4.626	1.602	8.462
LAG DEP	0.792482	0.829138	0.365066	0.810277	0.734791
	52.892	53.714	25.848	34.892	44.757
M CUR DEP	0.380726	0.510623	0.264193		
	4.402	2.754	5.111		
M LAG DEP	-0.408962	-0.429713	-0.113667	0.095189	
	4.934	2.541	5.163	3.492	
TOT REV	0.141235	0.010752	0.036727	0.010642	0.00166127
	8.263	2.717	14.736	11.568	5.062
INPP82		0.00272869	0.00590580	0.00131584	0.000692397
		2.153	7.221	3.945	5.822
POP82					
MEDAGE			1.45798		
			3.980		
YOUNG				-0.915383	
				3.531	
OLD				-0.401180	
				2.488	
BLACK					0.180097
					5.720
WHITE					0.168022
					5.926
HIGH				-0.185157	
				2.242	
COLLEGE	6.37822				0.094943
	4.672				3.592
DIVORCE				1.13192	
				3.727	
HVAL	-0.00235306				
	3.041				
RENTP					
VACANT				0.236115	0.095119
				2.887	2.994
UNEMP		1.68686			
		2.108			
HARD					
IDLE					
POVERTY					
URBAN	-1.63862		-0.532683		0.067209
	5.107		10.056		8.551
DENSITY	0.058003	0.00498583		0.00499670	0.00217694
	5.449	1.972		7.461	8.981
METHOD	2SLS(IV)	2SLS(IV)	2SLS(IV)	OLS	OLS
OBS	3087	2995	3082	3089	3067
STD ERR	386.997	93.550	64.247	22.186	8.217
R-SQU	.790	.594	.599	.744	.777
ADJ R-SQU	.785	.586	.592	.739	.772
F-STAT	195.778	75.373	79.343	146.780	177.324

Table 3 (continued)
Estimated Expenditure Equations

	PARKS & REC	WELFARE & HOUS	SANITATION	FIN & ADM	UTILITY
CONSTANT	-12.4358	-47.9309	-96.8230	-93.0630	-77.4189
	2.763	6.051	5.796	-3.962	2.454
LAG DEP	0.663855	0.301898	0.170138	0.539226	0.505426
	32.999	28.965	9.830	23.959	45.814
M CUR DEP	0.422974				
	3.626				
M LAG DEP	-0.205959				
	2.018				
TOT REV	0.00520983	0.026549	0.015304	0.058684	0.176271
	4.705	14.204	9.240	9.494	15.776
INPP82	0.00124695			0.011140	
	3.508			5.789	
POP82					
MEDAGE					
YOUNG					
OLD					
BLACK			0.600922		
			3.601		
WHITE			0.648347		
			4.225		
HIGH					
COLLEGE			0.518574		
			3.388		
DIVORCE					
HVAL			0.000442656		
			5.114		
RENTP		0.539279	0.588644		
		3.710	3.687		
VACANT		-0.506326			
		2.986			
UNEMP		1.85880			
		4.971			
HARD					
IDLE		0.930887			
		3.849			
POVERTY					
URBAN			0.084798	-0.339654	0.430330
			2.405	2.957	2.629
DENSITY		0.020406	0.00568561		
		15.351	4.817		
METHOD	2SLS(IV)	OLS	OLS	OLS	OLS
OBS	3060	2929	3033	3092	3052
STD ERR	30.113	44.812	41.547	157.913	242.536
R-SQU	.419	.711	.323	.383	.658
ADJ R-SQU	.408	.705	.310	.372	.652
F-STAT	38.901	123.969	24.083	34.907	108.693

for comparison). In terms of revenues, the model is best at explaining state transfers, tax rates, and utility revenues ($\mathbf{R^2} \geq .8$). For expenditures, the model is best at explaining education, police protection, fire protection, and welfare and housing expenditures ($\mathbf{R^2} \geq .7$). However, the model explains health and hospital, transportation, and utilities expenditures reasonably well (i.e., $.5 < \mathbf{R^2} < .7$)

EVALUATING THE LPFI MODEL PERFORMANCE

The local area public finance impact model developed within this report has been evaluated econometrically above. This, however, provides little in the way of performance evaluation under a variety of conditions. For example, how well does the model perform within each state of the country? Does the model predict revenues and expenditures better within metropolitan counties or in non-metropolitan counties? Does it matter which way the geography is delineated, by state or by economic area? Or, how much better does the model predict in comparison with another local public finance model?

Measuring Prediction Error:[15] In the previous section, the $\mathbf{R^2}$ statistic adjusted for degrees of freedom was used to evaluate the overall goodness of fit for the model. One way of evaluating the accuracy or performance of the model is to compare the model's predictions against actual historical data in terms of percentage errors.

The *percentage error* (**%ERR**) for revenue or expenditure category **i** in county **j** at time **t** is

$$\mathbf{\%ERR_{ijt}} = \mathbf{100} \times \frac{\mathbf{PRE_{ijt}} - \mathbf{ACT_{ijt}}}{\mathbf{ACT_{ijt}}} \qquad [4]$$

where $\mathbf{PRE_{ijt}}$ is the model's prediction of revenue or expenditure category **i** in county **j** at time **t** and $\mathbf{ACT_{ijt}}$ is the historical level of revenue or expenditure category **i** in county **j** at time **t**. Then for any level of geographic aggregation, the *mean prediction error* for revenue and expenditure category **i** at time **t** can be computed as

$$\mathbf{MPE_{it}} = \sum_{\mathbf{j}} \frac{\mathbf{\%ERR_{ijt}}}{\mathbf{n_j}}$$

where $\mathbf{n_j}$ is the number of counties in the subject geographic aggregation.

The percentage error and the mean percentage error has a serious flaw. That is, one county may have a 2% error and another county may have a -2% error. When these counties are combined, their percentage errors will cancel out. The *mean absolute percentage error* (**MAPE**) corrects for this problem because it is the average of the absolute percentage error. The absolute percentage error of a 2% or a -2% error is still a 2% error. The **MAPE** for revenue or expenditure category **i** at time **t** is

$$\mathbf{MAPE_{it}} = \frac{\mathbf{1}}{\mathbf{n_j}} \sum_{\mathbf{j}} \mathbf{100} \times \left| \frac{\mathbf{PRE_{ijt}} - \mathbf{ACT_{ijt}}}{\mathbf{ACT_{ijt}}} \right|$$

[15]This discussion is based largely on that found in Treyz (1993, pp. 57-59).

The **MAPE** shows the average percentage error for a grouping of counties, but it does not indicate whether there is a bias in the predictions.[16]

An Alternative Model:[17] A common method of evaluating regional economic models is to compare a proposed model (i.e., the model developed herein) with a currently used model. This model, called the Economic Impact Forecast System (**EIFS**) impact forecast model, acts as both an information source and as an analytical tool. EIFS allows its users to "define" an economic region of influence (ROI) by simply identifying the counties (typing in the county names) to be analyzed. Once the ROI is defined, the system aggregates the data, calculates "multipliers" and other variables used in the actual models, and is ready for user input data.

Figure 9 illustrates the general model structure found in all of the EIFS impact forecast models. This figure is useful because it not only shows the relationship that actions and projects have with their regional economies, but it also summarizes the interrelationships among the various economic and social sectors of the community.

Proposed actions and projects usually involve changes in personnel, wages and salaries, and procurement for materials and supplies. In EIFS, personnel are classified as either civilian or military. Factors are applied to capture the unique nature of the residential and consumption behavior of each of these groups. The actions and projects lead to changes in the demand for goods and services either from the personnel spending their incomes to support their families or from purchases to carry out project activities. Initial expenditures for goods and services are called the ***direct project effects***. In turn, direct project effects lead to further changes in the demand for productive requirements through the technical relationships that exist between the requirements needed to produce the goods and services and the commodities that are produced. Subsequent impacts that result from the initial round of spending are called the ***indirect project effects***.

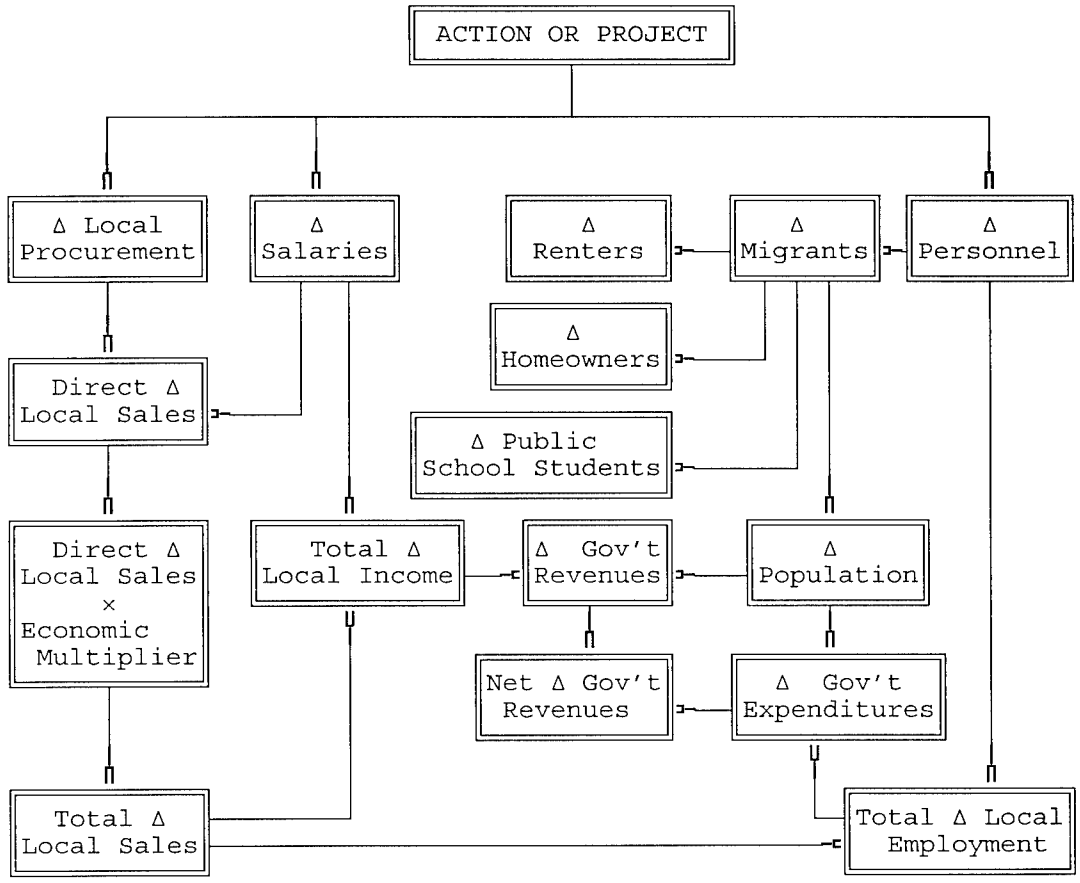
According to Figure 9, the EIFS impact forecast model estimates changes in county and local government revenues are estimated as a consequence of changes in local income and population. Changes in county and local government expenditures are derived in response to changes in local employment and population. The specific equations that the EIFS model uses to estimate local government revenues and expenditures are,

$$\Delta GR = \Delta Ytr \times \frac{ownsource}{yres} + \Delta POP \times \frac{xfers}{totpop} \qquad [4a]$$

$$\Delta GE = (\Delta POP + \Delta EMt) \times \frac{totexp}{totpop + totemp} \qquad [4b]$$

[16]That is, whether the predictions tend to be too high or too low.

[17]The alternative model described here is documented by Huppertz and Bloomquist (1992).



where **ΔGR** = change in local government revenues
ΔGE = change in local government expenditures
ΔYtr = change in residence income
ΔPOP = change in population
ΔEMt = change in employment
ownsource = ownsource revenue (total revenues minus total transfers)
yres = residence income
xfers = total revenue transfers
totpop = total population
totexp = total local government expenditures
totemp = total employment

FIGURE 9: Generic EIFS Impact Forecast Model

Data on historical public revenues and expenditures are from the Census of Governments and historical income, population, and employment data are from the Bureau of Economic Analysis. Both source are defined for the same year. The changes in income, population, and employment are generated in the EIFS impact forecast model as a result of some proposed action or project (see Figure 9 above).

Compatibility of LPFI and EIFS Models: There are only a few compatibility issues that inhibit direct comparisons between the revenue and expenditure forecasts of the Local Public Finance Impact model and the Economic Impact Forecast System impact forecast model. Both models use the same sources of base data; both models can estimate local public finance impacts for the same time periods and for the same levels of geography.

The major overriding issues of compatibility are impact detail and per capita impacts vs level impacts. LPFI estimates public finance impacts in terms of individual categories of revenues and expenditures, while EIFS estimates total revenue and expenditure impacts. Also, LFPI estimates revenue and expenditure impacts in per capita terms,[18] while EIFS estimates levels of revenues and expenditures.

Two steps were taken to ensure the compatibility of the two models' estimates of public finance impacts. First, because the LPFI model estimates its impacts for 1987 in terms of what public officials know in 1982, the EIFS model parameters were computed using 1982 base data. In addition, the income, population, and employment changes were computed between 1982 and 1987. Second, the predicted results of the LPFI model by revenue and expenditure category were converted to levels, aggregated to total revenues and total expenditures, and then converted back to a per capita basis. The EIFS predictions were converted to a per capita basis.

Prediction Error Analysis in Total: MAPE statistics were computed for per capita total revenue and total expenditure predictions for both the EIFS and LPFI models. These MAPE statistics were first calculated in total for the United States and for counties within metropolitan statistical areas and for those counties outside metro areas. The summary MAPE statistics are shown below in Table 4.[19] Note, the EIFS model revenue predictions are about 100 percent (%) higher than those of the LFPI model and the expenditure impacts are about one-third higher. Also, the disparities between the revenue and expenditure MAPE statistics are far greater for the EIFS model as the disparities for the LPFI model.

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[18]Except for tax rates and education expenditures per student.

[19]The large sizes of the average absolute percentage error is due to the fact that a number of counties in the United States changed their revenue and expenditure habits rather significantly during the period 1982 and 1987. These significant changes in local public finance behaviors are due in part to the shifting funding and expenditure responsibilities from the Federal level to the state and local levels. In addition, there has been a recent trend in "privatizing" local services (i.e., selling local public services for private ventures) or ceasing certain services (e.g., closing local public hospitals where large regional facilities are available).

Table 4
Mean Absolute Percentage Error Analysis: Total United States Per Capita Local Government Revenues and Expenditures

	Current Eifs Model		LPFI Model	
	Rev	Exp	Rev	Exp
Total	23.2	15.3	11.8	11.9
Metro	20.8	14.0	10.5	10.0
Non-Metro	24.0	15.7	12.2	12.5

Prediction Error Analysis by Geographic Area: Similar analyses were carried out for states, BEA economic areas, and for the metropolitan and non-metropolitan portions of states (see, respectively, Tables 5, 6, and 7). The overwhelming conclusion is that the performance comparison between the public revenue and expenditure predictions of the LPFI and the EIFS models that was noted for the United States as a whole also holds for states, BEA economic areas, and metro/non-metro areas of states. That is, the MAPE statistics for the LPFI model are substantially lower than for the EIFS model.

Table 5 - MAPE Analysis by State: Per Capita Revenues and Expenditures

	Current Eifs Model		LPFI Model	
	Rev	Exp	Rev	Exp
Alabama	28.4	17.1	12.0	14.0
Alaska	72.6	54.3	29.1	26.9
Arizona	22.8	17.2	18.4	11.4
Arkansas	26.1	16.4	11.7	14.3
California	16.9	13.4	7.5	7.7
Colorado	17.4	17.4	15.1	15.8
Connecticut	19.1	18.7	9.1	9.3
Delaware	34.6	6.4	8.0	5.0
Dist of Columbia	15.2	9.2	0.0	0.7
Florida	24.4	16.1	11.9	14.2
Georgia	20.7	19.9	17.3	16.4
Hawaii	33.5	13.9	8.6	10.8
Idaho	16.7	12.5	10.8	12.5
Illinois	27.0	10.3	10.6	10.3
Indiana	23.2	13.3	10.7	9.6
Iowa	23.2	8.9	8.7	7.1
Kansas	19.7	13.9	12.4	9.7
Kentucky	18.6	18.5	16.4	15.7
Louisiana	23.3	14.3	13.1	14.6
Maine	22.5	15.8	7.4	7.0
Maryland	33.4	10.9	9.2	10.9
Massachusetts	26.0	12.5	9.4	9.4
Michigan	23.5	12.2	9.8	9.7
Minnesota	18.9	13.3	12.8	13.6
Mississippi	29.3	13.9	17.1	14.7
Missouri	29.4	12.5	10.9	10.5
Montana	30.1	17.0	17.8	15.1
Nebraska	27.8	11.2	11.8	10.0
Nevada	26.0	18.8	14.5	15.5
New Hampshire	33.2	10.6	6.5	6.0
New Jersey	27.8	13.5	11.0	12.5
New Mexico	28.0	16.4	17.0	13.3
New York	17.7	11.0	5.7	5.7
North Carolina	21.8	14.2	10.6	9.5
North Dakota	26.8	13.2	8.4	12.2
Ohio	18.0	11.8	6.6	6.7
Oklahoma	20.1	15.3	10.9	13.7
Oregon	31.3	10.2	11.1	9.5
Pennsylvania	14.5	17.7	9.2	10.3
Rhode Island	30.4	8.2	5.8	2.4
South Carolina	25.2	17.0	14.3	17.2
South Dakota	34.8	11.6	14.8	10.3
Tennessee	35.0	14.3	10.4	13.6
Texas	16.0	22.8	12.4	13.2
Utah	24.5	15.8	14.1	14.1
Vermont	9.8	16.8	7.4	7.8
Virginia	21.9	16.7	11.1	11.4
Washington	15.4	15.8	8.9	10.3
West Virginia	21.1	17.3	11.0	13.9
Wisconsin	24.1	9.8	5.7	6.0
Wyoming	17.1	17.2	12.0	15.8

Table 6 - MAPE Analysis by BEA Area: Per Capita Revenues and Expenditures

	# of cnty	Current EIFS Model Rev	Current EIFS Model Exp	LPFI Model Rev	LPFI Model Exp
Aberdeen SD	13	44.0	7.0	11.7	7.5
Abilene TX	18	14.3	21.6	8.0	13.8
Albany GA	27	17.7	18.9	12.9	12.6
Albany NY	15	19.4	12.4	6.2	5.0
Albuquerque NM	18	28.2	15.2	14.8	11.2
Amarillo TX	33	27.9	21.0	17.0	14.9
Anchorage AK	17	72.6	54.3	29.1	26.9
Anderson IN	9	34.0	11.4	12.4	9.7
Appleton WI	26	25.4	9.6	7.2	8.3
Asheville NC	15	16.2	18.4	9.4	9.3
Atlanta GA	52	24.6	18.6	15.1	15.6
Augusta GA	18	15.9	22.5	13.1	13.9
Austin TX	9	8.8	22.8	12.0	12.8
Baltimore MD	16	32.5	11.4	8.8	12.7
Bangor ME	6	23.9	17.5	5.2	6.2
Baton Rouge LA	13	23.7	14.2	17.3	13.2
Beaumont TX	7	9.1	19.6	3.8	8.4
Billings MT	25	34.4	14.4	22.3	12.8
Binghamton NY	12	15.4	15.2	7.2	8.8
Birmingham AL	24	29.0	10.1	8.8	10.3
Bismarck ND	18	27.1	13.5	7.9	12.8
Boise City ID	12	21.1	9.8	12.9	9.3
Boston MA	16	31.5	11.1	9.3	8.6
Brownsville TX	4	15.0	15.6	13.2	18.8
Buffalo NY	8	12.1	13.2	4.9	6.1
Burlington VT	15	13.3	16.9	6.9	8.4
Cedar Rapids IA	7	26.0	7.2	7.8	6.2
Champaign IL	8	31.2	7.0	11.7	6.0
Charleston SC	4	34.8	14.9	25.2	18.7
Charleston WV	18	16.0	19.1	9.9	13.5
Charlotte NC	18	26.8	15.7	10.5	9.7
Chattanooga TN	19	26.4	14.9	10.7	10.8
Cheyenne WY	10	14.0	12.4	9.6	15.2
Chicago IL	23	22.5	10.9	10.7	9.8
Cincinnati OH	26	20.2	17.5	11.9	11.4
Cleveland OH	19	15.4	11.3	5.7	5.0
Colorado Springs CO	22	22.4	13.9	16.7	14.5
Columbia MO	23	28.5	14.0	12.1	12.4
Columbia SC	11	22.7	13.4	12.0	18.1
Columbus GA	15	30.8	23.6	44.2	27.9
Columbus OH	24	20.2	12.6	7.2	8.8
Corpus Christi TX	11	14.7	21.7	11.2	11.0
Dallas TX	27	15.7	24.7	16.5	17.3
Davenport IA	15	20.6	12.4	10.3	7.3
Dayton OH	9	23.9	9.2	5.7	5.7
Denver CO	22	15.3	19.3	13.8	14.1
Des Moines IA	27	20.2	9.7	8.0	6.9
Detroit MI	10	27.4	9.4	10.3	9.6
Dubuque IA	10	32.7	7.3	4.9	6.0
Duluth MN	12	14.5	14.6	9.8	10.0

Table 6 (continued)

	# of cnty	Current EIFS Model Rev	Exp	LPFI Model Rev	Exp
Eau Claire WI	8	24.4	10.6	5.2	5.0
El Paso TX	14	27.8	20.7	16.8	17.4
Erie PA	6	11.8	28.3	10.9	12.0
Eugene OR	8	41.9	18.9	10.6	16.1
Eureka CA	3	37.7	14.3	15.0	19.2
Evansville IN	25	17.5	16.6	12.8	13.2
Fargo ND	19	26.4	11.2	8.4	8.3
Fayetteville AR	11	31.6	25.8	13.4	18.2
Fayetteville NC	7	16.4	12.2	6.0	3.2
Florence SC	9	28.3	16.8	16.9	19.2
Fort Dodge IA	15	23.3	11.5	12.0	10.9
Fort Smith AR	14	35.5	18.1	8.7	13.7
Fort Wayne IN	11	27.0	11.1	6.0	7.8
Fresno CA	5	9.1	15.0	8.2	4.8
Grand Forks ND	20	29.2	15.1	10.5	14.5
Grand Island NE	47	30.3	11.4	12.2	10.9
Grand Junction CO	20	13.9	20.8	13.9	18.0
Grand Rapids MI	21	24.8	10.9	9.5	9.6
Great Falls MT	19	21.8	18.9	10.7	13.6
Greensboro NC	17	19.9	12.3	8.3	7.9
Greenville SC	11	27.5	16.5	15.5	20.4
Harrisburg PA	12	17.1	10.8	9.9	9.6
Hartford CT	13	20.2	15.1	7.7	7.7
Honolulu HI	4	33.5	13.9	8.6	10.8
Houston TX	30	12.6	23.4	9.1	10.5
Huntington WV	18	16.8	22.2	16.2	15.9
Huntsville AL	9	25.4	9.1	7.7	7.8
Indianapolis IN	21	27.7	10.1	10.1	9.2
Jackson MS	35	22.8	12.2	12.4	10.1
Jacksonville FL	23	25.2	17.7	14.6	17.9
Johnson City TN	19	18.8	20.4	8.0	14.5
Kansas City MO	39	25.6	9.9	10.9	8.1
Knoxville TN	24	26.4	14.7	10.3	12.0
Kokomo IN	6	21.4	9.8	6.5	6.2
La Crosse WI	9	20.4	11.0	6.1	5.6
Lafayette IN	8	17.3	13.2	11.3	7.9
Lafayette LA	8	12.1	11.1	9.1	10.3
Lake Charles LA	6	20.1	10.2	7.3	11.8
Lansing MI	11	17.2	12.4	12.1	8.0
Las Vegas NV	9	27.6	13.6	10.5	15.6
Lawton OK	9	19.8	17.0	11.6	11.6
Lexington KY	39	19.0	18.1	16.8	17.4
Lima OH	6	18.6	12.8	3.8	3.6
Lincoln NE	15	15.8	10.9	4.9	7.1
Little Rock AR	39	22.4	17.5	11.7	14.1
Los Angeles CA	9	15.9	13.9	6.9	5.9
Louisville KY	24	18.6	16.6	16.0	13.7
Lubbock TX	20	28.9	20.3	18.4	14.9
Macon GA	25	15.7	21.9	14.5	16.2
Madison WI	8	22.7	7.4	3.3	5.5
Memphis TN	67	31.8	13.2	12.4	12.1

Table 6 (continued)

	# of cnty	Current EIFS Model Rev	Current EIFS Model Exp	LPFI Model Rev	LPFI Model Exp
Miami FL	10	13.2	15.3	8.7	6.2
Milwaukee WI	9	27.5	11.7	6.9	7.0
Minneapolis MN	51	21.1	11.4	14.0	13.4
Minot ND	16	14.1	18.1	10.4	13.3
Missoula MT	13	32.5	15.8	16.7	19.5
Mobile AL	13	18.1	39.1	11.8	25.7
Monroe LA	14	35.1	15.7	16.0	17.6
Montgomery AL	20	33.4	14.1	18.5	13.0
Morgantown WV	11	15.7	15.1	11.8	12.4
Nashville TN	51	32.6	16.4	11.2	15.2
New Orleans LA	23	37.6	19.1	27.2	26.7
New York NY	24	27.0	12.0	11.4	11.0
Norfolk VA	23	21.9	15.3	13.1	11.8
Odessa TX	13	15.9	22.9	8.6	15.0
Oklahoma City OK	36	14.7	13.7	10.6	11.7
Omaha NE	20	25.1	7.3	8.5	7.6
Orlando FL	8	23.2	15.2	12.4	13.3
Paducah KY	15	17.9	13.4	11.7	9.9
Parkersburg WV	5	19.1	20.3	14.3	14.2
Pensacola FL	8	35.4	11.3	15.4	21.1
Peoria IL	12	16.6	16.5	14.6	12.2
Philadelphia PA	23	21.5	14.5	11.0	10.2
Phoenix AZ	9	21.5	20.4	19.6	10.1
Pittsburgh PA	16	7.9	16.5	6.8	6.2
Pocatello ID	22	17.3	14.3	10.3	15.7
Portland ME	10	21.7	14.8	8.7	7.6
Portland OR	23	20.9	7.9	9.2	8.1
Providence RI	5	30.4	8.2	5.8	2.4
Quincy IL	7	17.2	16.2	6.4	13.5
Raleigh NC	12	34.0	13.7	16.7	16.3
Rapid City SD	31	26.3	11.0	19.9	11.4
Redding CA	6	18.3	11.7	9.9	12.7
Reno NV	13	28.9	20.5	17.8	17.4
Richland WA	11	30.7	22.0	14.8	14.6
Richmond VA	35	23.4	18.2	13.6	11.6
Roanoke VA	28	19.7	16.7	7.4	8.9
Rochester MN	7	19.6	22.7	14.1	15.9
Rochester NY	8	10.0	10.8	2.0	4.2
Rockford IL	6	23.6	10.2	5.7	10.6
Rocky Mount NC	19	20.5	11.5	11.4	8.5
Sacramento CA	11	18.4	13.3	6.9	7.5
Saginaw MI	23	23.6	14.8	10.2	10.7
Salina KS	27	16.0	15.0	10.2	10.7
Salt Lake City UT	29	22.7	17.3	14.4	15.5
San Angelo TX	16	17.7	24.1	16.2	17.9
San Antonio TX	26	12.3	20.6	12.4	9.9
San Diego CA	2	12.0	6.4	2.3	3.6
San Francisco CA	14	14.8	14.7	7.5	6.4
Savannah GA	22	21.3	17.7	13.3	14.8
Scotts Bluff NE	12	39.0	10.9	18.9	8.2
Scranton PA	6	18.3	16.8	7.5	8.8

Table 6 (continued)

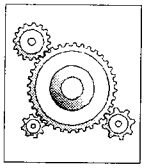
	# of cnty	Current EIFS Model Rev	Exp	LPFI Model Rev	Exp
Seattle WA	15	14.9	12.1	6.6	7.6
Shreveport LA	13	22.9	14.8	13.6	14.8
Sioux City IA	23	24.4	9.9	9.7	9.0
Sioux Falls SD	32	31.4	14.3	10.7	13.5
South Bend IN	9	25.9	8.3	10.2	7.9
Spokane WA	20	15.2	11.6	10.4	7.3
Springfield IL	11	32.5	9.8	12.7	9.5
Springfield MO	38	24.6	13.8	10.1	10.3
St Louis MO	57	32.5	10.6	10.3	11.3
Stockton CA	8	16.9	12.6	5.2	7.4
Syracuse NY	11	20.5	8.7	6.1	4.6
Tallahassee FL	10	24.8	9.7	12.4	13.1
Tampa FL	14	21.9	22.7	10.2	14.7
Terre Haute IN	7	16.5	13.1	14.9	12.8
Texarkana TX	16	16.8	17.9	8.8	15.1
Toledo OH	11	18.6	10.6	6.1	6.4
Topeka KS	15	18.1	13.1	8.3	7.1
Tucson AZ	5	25.1	11.4	16.3	13.6
Tulsa OK	16	24.4	15.1	15.5	17.2
Tyler TX	16	11.8	24.6	7.3	11.0
Waco TX	12	8.3	26.6	10.9	7.3
Washington DC	31	36.2	12.2	10.4	13.4
Waterloo IA	16	23.4	6.4	7.2	5.5
Wausau WI	10	19.8	10.5	5.5	5.7
Wheeling WV	10	13.4	15.9	12.2	10.7
Wichita KS	43	24.2	15.1	16.7	10.6
Wichita Falls TX	9	10.6	17.8	14.1	15.0
Williamsport PA	12	19.1	20.3	8.6	14.8
Wilmington NC	6	15.0	17.3	7.7	11.8
Yakima WA	6	24.1	12.3	11.2	8.6
Youngstown OH	5	9.0	11.9	5.0	4.6

Table 7
Mean Absolute Percentage Error Analysis by Metro/Non-Metro Areas
Per Capita Revenues and Expenditures

		Current Eifs Model		LPFI Model	
		Rev	Exp	Rev	Exp
Alabama	Metro	25.2	9.7	9.2	8.6
	Non-Metro	29.6	20.0	13.1	16.1
Alaska	Metro	4.2	36.0	24.8	40.6
	Non-Metro	76.9	55.4	29.3	26.0
Arizona	Metro	15.5	19.5	17.5	12.8
	Non-Metro	24.1	16.8	18.5	11.1
Arkansas	Metro	16.4	18.7	6.0	8.2
	Non-Metro	27.7	16.0	12.6	15.2
California	Metro	15.9	13.3	6.5	6.7
	Non-Metro	18.1	13.6	8.6	9.0
Colorado	Metro	12.6	20.2	15.5	12.5
	Non-Metro	18.3	16.9	15.0	16.4
Connecticut	Metro	20.2	18.2	9.6	10.2
	Non-Metro	15.7	20.2	7.5	6.6
Delaware	Metro	28.2	4.2	1.9	3.2
	Non-Metro	37.8	7.5	11.0	5.9
Dist of Columbia	Metro	15.2	9.2	0.0	0.7
	Non-Metro	0.0	0.0	0.0	0.0
Florida	Metro	23.8	15.2	11.6	13.9
	Non-Metro	25.0	16.9	12.2	14.4
Georgia	Metro	15.9	17.8	21.8	14.4
	Non-Metro	22.2	20.6	15.9	17.1
Hawaii	Metro	34.1	16.7	12.9	8.9
	Non-Metro	33.4	12.9	7.2	11.5
Idaho	Metro	19.0	6.1	19.9	6.9
	Non-Metro	16.7	12.7	10.6	12.6
Illinois	Metro	27.7	11.2	9.9	9.2
	Non-Metro	26.7	10.1	10.9	10.7
Indiana	Metro	22.6	12.6	10.3	9.5
	Non-Metro	23.4	13.7	10.8	9.6
Iowa	Metro	16.0	6.9	6.0	5.4
	Non-Metro	24.0	9.1	9.0	7.4
Kansas	Metro	20.8	8.1	13.8	6.1
	Non-Metro	19.7	14.4	12.3	10.0
Kentucky	Metro	21.0	19.3	17.7	17.2
	Non-Metro	18.1	18.4	16.2	15.5
Louisiana	Metro	17.9	9.1	8.0	9.1
	Non-Metro	25.5	16.5	15.2	16.9
Maine	Metro	19.4	17.0	7.4	4.9
	Non-Metro	23.3	15.5	7.4	7.5
Maryland	Metro	34.2	10.8	8.5	10.5
	Non-Metro	31.9	10.9	10.2	11.7
Massachusetts	Metro	25.3	10.5	6.9	7.0
	Non-Metro	27.8	17.5	15.6	15.5
Michigan	Metro	20.7	9.4	6.9	6.4
	Non-Metro	24.6	13.3	10.8	10.9
Minnesota	Metro	22.8	10.6	15.3	13.1
	Non-Metro	18.0	13.9	12.2	13.7
Mississippi	Metro	27.8	14.9	20.4	11.1
	Non-Metro	29.4	13.8	16.8	15.0

Table 7 (continued)

		Current Eifs Model		LPFI Model	
		Rev	Exp	Rev	Exp
Missouri	Metro	32.1	8.7	13.6	8.9
	Non-Metro	28.9	13.1	10.5	10.8
Montana	Metro	27.6	12.8	18.2	9.5
	Non-Metro	30.1	17.1	17.8	15.4
Nebraska	Metro	21.9	8.5	11.2	11.7
	Non-Metro	28.1	11.4	11.8	9.9
Nevada	Metro	30.8	10.9	15.3	13.1
	Non-Metro	25.4	19.8	14.4	15.8
New Hampshire	Metro	25.4	13.5	7.3	7.5
	Non-Metro	36.6	9.3	6.1	5.3
New Jersey	Metro	28.0	13.3	11.4	13.0
	Non-Metro	25.7	18.5	3.0	1.9
New Mexico	Metro	27.3	18.7	19.6	18.3
	Non-Metro	28.1	16.0	16.6	12.6
New York	Metro	18.4	11.2	5.9	5.4
	Non-Metro	17.0	10.7	5.4	6.0
North Carolina	Metro	21.9	16.1	9.6	10.6
	Non-Metro	21.8	13.5	10.9	9.2
North Dakota	Metro	19.8	10.5	6.9	9.8
	Non-Metro	27.3	13.4	8.5	12.4
Ohio	Metro	19.5	9.5	6.1	5.7
	Non-Metro	17.0	13.4	7.0	7.4
Oklahoma	Metro	15.5	11.5	7.9	11.8
	Non-Metro	21.1	16.1	11.6	14.1
Oregon	Metro	23.2	5.8	10.3	8.2
	Non-Metro	33.6	11.4	11.3	9.9
Pennsylvania	Metro	11.6	16.5	7.8	7.4
	Non-Metro	17.2	18.8	10.6	13.2
Rhode Island	Metro	32.3	7.5	5.4	2.4
	Non-Metro	22.9	10.8	7.3	2.1
South Carolina	Metro	21.9	14.3	10.0	11.1
	Non-Metro	26.3	17.9	15.8	19.3
South Dakota	Metro	22.5	1.6	9.6	2.1
	Non-Metro	35.0	11.7	14.8	10.4
Tennessee	Metro	30.7	13.3	8.1	12.6
	Non-Metro	36.7	14.7	11.4	14.0
Texas	Metro	11.2	24.5	11.2	10.5
	Non-Metro	17.1	22.3	12.6	13.9
Utah	Metro	12.8	13.8	13.4	11.3
	Non-Metro	26.4	16.1	14.2	14.5
Vermont	Metro	13.5	15.5	12.8	11.7
	Non-Metro	9.1	17.0	6.5	7.2
Virginia	Metro	23.0	16.6	11.7	13.0
	Non-Metro	21.5	16.8	10.9	10.6
Washington	Metro	13.4	21.9	8.8	11.2
	Non-Metro	16.2	13.4	9.0	9.9
West Virginia	Metro	22.2	15.7	13.9	14.8
	Non-Metro	20.8	17.6	10.4	13.7
Wisconsin	Metro	25.9	9.0	7.9	5.5
	Non-Metro	23.4	10.1	4.9	6.1
Wyoming	Metro	2.8	14.8	9.2	15.4
	Non-Metro	18.4	17.4	12.3	15.9



APPENDIX A
REGION OF INFLUENCE DEFINITION

The assessment of socioeconomic impacts resulting from actions and projects can be one of the more controversial issues related to the realignment or closure of an installation. The economic and social well-being of a local community can be dependent upon the activities of the installation, and disruptions to the status quo become politically charged and emotion-laden. Of the many factors that are necessary to implement a socioeconomic impact analysis, probably one of the most challenged issues is the definition of the geographic region of influence (ROI).

The justifications of most study areas often are ignored--perhaps because the region is predefined (e.g., for an analysis of the fiscal impact of a tax cut within the State of Alabama) or maybe because the regions were the only available units of observation for a "cross-section" study. Unfortunately, few universally accepted rules are available to help an analyst choose a study area. Thus, the regional setting for an impact analysis is usually somewhat subjective or arbitrary. Careful thought and judgement should always be exercised when delineating regions.

CONCEPTUAL CONSIDERATIONS

Other than a geographic aggregate, what is a region? There are as many answers to this question as there are people who use geographic settings for their analyses. Such diversity of opinion is due mostly to the different uses of spatial aggregates.[20] Most regional and urban analysts performing socioeconomic impact analysis prefer the functional area concept for defining study regions.[21] Regions defined in this way explicitly consider the economic linkages and spatial dimensions between and among the residential population and businesses located in the geographic area. In other words, commuting and trading patterns are of prime concern. This type of region is often called "nodal" because:

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[20]Two other methods of defining regions are frequently used. First, regions are sometimes delineated along administrative or political boundaries (e.g., the State of Alabama). It is often claimed that since the institutional framework within which economic and social policies are designed and implemented is of overriding importance, then the geographic unit of analysis should coincide with the same administrative or political boundaries. Second, homogeneity of one form or another can be used to justify some regions. For example, one can envision coal mining regions, river-basin regions, air pollution regions, or even German-speaking areas. What binds these areas is usually some common physical, economic, social, or statistical characteristic.

[21]The concept of a functional economic area (FEA) appears attributable to Karl Fox (Fox and Kuman, 1965).

> ... the region is perceived as being composed of heterogeneous nodes of different size (cities, towns, villages and sparsely populated rural areas) that are linked together functionally. These functional links can be identified through observation of flows of people, factors, goods and communications (Richardson, 1979, p.21).

An examination of a map shows that population and businesses are not spread evenly over space, but are concentrated at specific locations called "agglomerations." The factors that generate these agglomerations are varied; e.g., transportation advantages (such as the confluence of several rivers), resource deposits, factor endowments, local infrastructure (such good schools and public transportation facilities), climate, and even proximity to firms that supply needed production requirements or provide ready markets.

Chalmers and Anderson (1977) discuss an important relationship between the size of a region and subsequent socioeconomic impacts. A larger area usually implies larger populations, greater factor endowments, richer resource deposits, and more readily available productive supplies. All these attributes make for more integrated and more diverse economic structures that, in turn, lead to larger socioeconomic impacts. On the other hand, larger regions also tend to dilute the strength of socioeconomic impacts, which means that the impacts tend to be relatively smaller.

PRACTICAL CONSIDERATIONS

Beyond the general conceptual guidelines for defining regions, there is little formal advice about defining regions. With respect to economic and fiscal impact analysis, it is probably obvious that a region should be the geographic area in which the significant economic and social consequences of a project occur. However an analyst decides to delineate a study area, the decision will have to be based on his/her considered judgement; possibly from past experience or, perhaps, based on specific knowledge of the area under consideration. As a practical matter, another important issue is determining the smallest geographic unit for which relevant data are available. For the most part, counties provide these data.[22]

The definition of the affected region must include all the ingredients of self-sustaining region-local businesses, local governments, and individuals. The region must reflect the limits of the economic activity associated with the affected population. This is not an easy definition to obtain and numerous "simplistic" attempts at a standard methodology have failed. Through experience, however, it has become obvious that the following considerations must be included in the definition of the ROI:

- The ***residence patterns*** of the affected personnel determine where they are likely to spend their salaries. There may be records of addresses of personnel which can serve as a means to document this consideration, or there may be an established perception among area residents regarding where the personnel at the affected installation live, and it is generally correct.

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[22]Although some data are available at the census tract level (e.g., population and income) which could possibly be used to delineate regions, the data needed to analyze economic impacts are most readily available only at the county level, unless one is willing to conduct expensive and time-consuming surveys.

- The availability of local ***shopping opportunities*** is also a factor in the regional definition. The location of new malls or other popular shopping opportunities can dictate an expansion in the region of influence if no comparable opportunities exist in the immediate vicinity.

- The "***journey-to-work***" time for employees often dictates part of the regional definition. On average, a journey-to-work time of one hour is considered a maximum criteria, however, some regions in the country are characterized by higher travel times for a typical commute. It is affected significantly by the quality of the transportation network, the availability of mass transit, and what impacts are felt during "rush hour" peaks.

- Local ***customs and culture*** often dictate the boundaries of the ROI. Long versus short commute patterns, willingness to approach the "inner city," the sense of local community, and other factors often lead to seeming inconsistencies in the regional definitions. These are unfortunately, hard to address factors, but are nonetheless a fact of life which must enter into the analysis process and the definition of the ROI.

None of the considerations above can be used exclusively to define ROIs for all socioeconomic studies. It is necessary that <u>all</u> these considerations enter into the ROI definition process. This often requires input from local personnel in addition to analysis of secondary data (maps, data, etc).

RECOMMENDATIONS

For the purposes of procedural recommendations, one should think of defining an ROI as a process consisting of three steps (Chalmers and Anderson, 1977):

- Define the direct impact area,
- Define the direct/indirect impact area, and
- Perform geographic sensitivity analysis.

The direct impact area is the region where the personnel and their dependents reside and do the majority of their shopping. This is where the strongest socioeconomic impacts of the proposed action or project will occur. The direct/indirect impact area is the geographic region where the great majority of the economic effects induced by the spending behavior of the affect personnel, their dependents, and any expenditures for services and supplies is expected to occur. Note, the direct/indirect impact area is the ROI that is used for the socioeconomic impact analysis and for the subsequent the significance evaluation. Although step one is relatively straight forward, assuming that the residential patterns of the affected personnel are readily available, steps two and three may have to be performed several times during a socioeconomic impact analysis.

Step 1: Define the Direct Impact Area

The direct impact area is determined by the residential patterns of the personnel affected by the proposed action. In the case of plant closures, the residential patterns of the present staff is probably adequate the purposes here. Care should be taken to accurately locate the residences of as many of the personnel as possible; e.g., 95 percent or more. This information should be available from a personnel office or from project records.

In the case of military installation expansions, the size and personnel composition of the proposed action compared with the present personnel population may require further consideration of local residential opportunities, beyond the residential patterns of the present post personnel staff, in order to properly define the direct impact area. For example, if an installation is located in a predominantly rural area, with limited housing and local educational facilities, and the proposed action is to double the present staff at the installation with a different mission (such as adding a new major headquarters activity at an installation with a historical operations or distribution mission), then in order to determine the residential patterns of the new personnel may require a significant evaluation of adequacy of local housing opportunities and infrastructure requirements.

If the residential patterns of the personnel are not available, or if they are not applicable to the impact scenario under study, then one could consider using a secondary data method of defining the direct impact area that appeals to a labor force concept of an area.[23] For example, consult a map and, using a convenient radius, specify the geographic area surrounding the action or project within which employees are likely to reside and shop. In other words, how far do the affected personnel commute to work? As an example, from a recent survey of Air Force personnel, Gunther (1982) found that fewer than one percent (1%) of Air Force personnel reside further than 50 miles from their installations.

Step 2: Define the Direct/Indirect Impact Area

The direct/indirect impact area is the area where the spending and respending due to the proposed action or project, implied by the economic processes, are most likely to occur. This is, in fact, the same as the ROI. Defining the direct/indirect impact area is not as straightforward as determining the just the direct impact area, because it requires has more elements of subjective judgement. As a practical matter, the direct/indirect impact area includes the direct impact area, as well as those communities in the surrounding areas where significant effects are likely to occur because of local interrelationships between consumers, merchants, and industrial suppliers.

In most cases, this means that the direct/indirect impact area (and the ROI itself) will be larger than the primary impact area. How much larger will vary depending on the overall region being studied. The more sparsely settled a study area, the larger the market area of the wholesale-retail center with the consequence that the ROI (direct/indirect impact area) could contain large areas not already included in the direct impact area. In more densely settled parts of the country, less difference will exist in the geographic boundaries of the two areas and they may even coincide (Chalmers and Anderson, 1977, p. 40).

Considering the importance of trade activity in the economic process, the direct/indirect impact area should not only contain the direct impact area, but also any nearby trade and service centers and their market areas as well (***shopping opportunities***). Other, difficult to address factors can also play an important role in defining the direct/indirect impact area; for example, commuting patterns, sense of "community," and attractiveness of the inner city (***customs and culture***). Local officials and other knowledgeable individuals may have to consulted to adequately consider these factors. In addition,

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[23]Please note, this should be the "last resort" method of defining a direct impact area. Always use the residential patterns of personnel if they are available and are applicable.

natural boundaries (such as rivers, mountain ranges, major highways) will need to be evaluated to properly define the direct/indirect impact area.

Metropolitan Statistical Areas (MSA) boundaries may delineate the direct/indirect impact area. MSAs include a central city or cities and the surrounding territory that is economically and socially dominated by the city. Since the MSA is a major regional trade and service center, it is often an appropriate choice for a direct/indirect impact area.[24] If the direct impact area does not fall within the limits of any MSA, the analyst must decide which, if any MSA to include in the direct/indirect impact area. Choosing the nearest MSA to the direct impact area may not be appropriate, as that MSA may not be the trade and service center that most attracts the shoppers from the direct impact area. The Economic Impact Forecast System (EIFS) contains the geographic definitions of MSAs and Bureau of Economic Analysis (BEA) Economic Areas within the United States, so that they can be accessed directly when entering EIFS.[25]

Step 3: Perform Geographic Sensitivity Analyses

Examine the selected ROI thoroughly. A proposed project may affect areas outside the boundaries a proposed region, such as a county or Metropolitan Statistical Area (MSA). Use as much knowledge of the area as can be gleaned from maps, data, local officials, and other socioeconomic impact analyses to determine the areas that can be affected by the action in question. Run the LPFI/EIFS models several times, varying the boundaries of the study area, to see how the socioeconomic impacts change as the geographic area changes. Keep these runs in your records for future reference.

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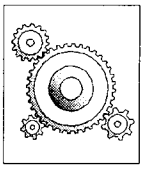
[24]The current standards for the establishment and definition of MSAs were adopted in January 1980. They provide that each MSA must include at least one city with 50,000 or more inhabitants, or a Census Bureau defined urbanized area of at least 50,000 inhabitants and a total MSA population of at least 100,000 (75,000 in New England). MSAs include as a central county(ies) the county in which the central city is located, and adjacent counties, if any, with at least 50 percent of their population in the urbanized area. Additional outlying counties are included if they meet specified requirements of commuting to the central counties and of metropolitan character (such as population density and percent urban).

[25]BEA Economic Areas offers alternative direct/indirect impact area definitions that provides complete geographic coverage of the United States (BEA, 1977). These areas, 183 in all, are "nodal" functional area delineated to facilitate regional economic analysis. Each area consists of an economic node--an MSA or similar area, that serves as a center of economic activity--and the surrounding counties that are economically related to the center. To the extent possible, each area includes the place of work and place of residence of is labor force.



APPENDIX B
VARIABLE AND DATA SOURCES USED IN THE LPFI MODEL

Revenue Variables (1982 and 1987)

FEDERAL XFERS	Federal transfers per capita (3&4)
STATE XFERS	State and local transfers per capita (3&4)
TAX RATE	Local taxes as a percent of personal income (3&4)
CHG & MISC	Charges and miscellaneous revenue per capita (3&4)
UTILITY	Utility, liquor store, and insurance trust revenue per capita (3&4)

Expenditure Variables (1982 and 1987)

EDUCATION	Education expenditures per student (1,3,4)
HLTH & HOSP	Health and hospital expenditures per capita (3&4)
TRANSPORT	Transportation expenditures per capita (3&4)
POLICE PROT	Police protection and corrections expenditures per capita (3&4)
FIRE PROT	Fire protection expenditures per capita (3&4)
PARKS & REC	Natural resources, parks, and recreation expenditures per capita (3)
WELFARE & HOUS	Public welfare, housing, and community development expenditures per capita (3&4)
SANITATION	Sewerage and sanitation expenditures per capita (3&4)
FIN & ADM	Government finance, administration, general, and debt interest expenditures per capita (3&4)
UTILITY	Utility, liquor store, and insurance trust expenditures per capita (3&4)

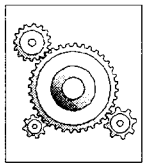
Explanatory Variables

LAG DEP	1982	Dependent variable (2)
M CUR DEP	1987	Neighbors' average dependent variable (3)
M LAG DEP	1982	Neighbors' average dependent variable (2)
FED TRN	1982	Federal transfers per capita (2&4)
S&L TRN	1982	State and local transfers per capita (2&4)
TAX RATE	1982	Local taxes as a percent of personal income (2&4)
INPP82	1982	Income per capita (4)
POP82	1982	Population (4)
MEDAGE	1980	Median age of population (1)
YOUNG	1980	Percent of population that is school-aged: 3-18 (1)
OLD	1980	Percent of population over age 60 (1)
TEENT	1980	Percent of population that are teens (1)
BLACK	1980	Percent of population that is black (1)
WHITE	1980	Percent of population that is white (1)
HIGH	1980	Percent of population that finished high school (1)
COLLEGE	1980	Percent of population that ever attended college (1)
MARRIAGE	1980	Percent of population over age 15 that are married (1)

DIVORCE	1980	Percent of population over age 15 that are divorced or separated (1)
HVAL	1980	Median housing value (1)
RVAL	1980	Median rental value (1)
RENTP	1980	Percent of population living in rental housing (1)
VACANT	1980	Percent of housing that is vacant (1)
UNEMP	1980	Unemployment rate (1)
FLABOR	1980	Percent of females in labor force (1)
HARD	1979	Percent of working-aged population unemployed 15 weeks or more (1)
IDLE	1979	Percent of families with no workers (1)
POVERTY	1980	Percent of families below the poverty level with children aged 6-17 (1)
URBAN	1980	Percent of population living in urban area (1)
DENSITY	1982	Population density (4)

Sources:
(1) 1980 Census of Population and Housing
(2) 1982 Census of Governments
(3) 1987 Census of Governments
(4) U.S. Bureau of Economic Analysis

All monetary values were deflated to a base year of 1982 using the PCE deflator from the U.S. Bureau of Economic Analysis.



APPENDIX C
DEFINITIONS OF GOVERNMENT FINANCE DATA[26]

General Revenue.

All government revenue except utility revenue, liquor store revenue, and employee-retirement and other insurance trust revenue. The basis of distinction is not the fund or administration unit receiving particular amounts, but rather the nature of the revenue source concerned.

Intergovernment Revenue.

Amounts received from other governments as fiscal aid in the form of shared revenues and grants-in-aid, as reimbursements for performance of general government functions and specific services for the paying government (e.g., care for prisoners or contractual research) or in lieu of taxes. Excludes amounts received from other governments for sale of property, commodities, and utility services. All intergovernmental revenue is classified as general revenue.

Federal Transfers.

Intergovernmental revenue received by a government directly from Federal Government. For local governments excludes Federal aid channeled through state governments.

State and Local Transfers.

Fiscal aid revenue that allows the receiving government unrestricted use as a function or purpose.

Local Taxes.

Compulsory contributions exacted by a government for public purposes, except employee and employer assessments for retirement and social insurance purposes, which are classified as insurance trust revenue. All tax revenue is classified as general revenue and comprises amounts received (including interest and penalties but excluding protested amounts and refunds) from all taxes imposed by a government. Note that local government tax revenue excludes any amounts from shares of state-imposed and collected taxes, which are classified as Intergovernment Revenue.

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[26]Selected definitions from *Attachment 5 (Definitions of Selected Terms)* of the *Census of Governments, 1987: Finance Statistics (Technical Documentation)*. Washington, DC: U.S. Department of Commerce, Bureau of the Census (1990).

Corporate Net Income Taxes. Taxes on net income of corporations and unincorporated businesses (when taxed separately from individual income). Include distinctively imposed net income taxes on special kinds of corporations (e.g., financial institutions).

Death and Gift Taxes. Taxes imposed on the transfer of property at death, in contemplation of death, or as a gift.

Individual Income Taxes. Taxes on individuals measured by net income and taxes distinctively imposed on special types of income (e.g., interest, dividends, income form intangibles, etc.).

License Taxes. Taxes enacted (either for revenue raising or for regulation) as a condition to the exercise of a business or non-business privilege, at a flat rate or measured by such bases as capital stock, capital surplus, number of business units, r capacity. Excludes taxes measured directly by transactions, gross or net income, or value of property except those which only nominal rates apply. "License" based on these latter measures, other than those at nominal rates, are classified according to the measure concerned. Includes "fees" related to licensing activities--automobile inspection, professional examinations, and licenses, etc.--as well as license taxes producing substantial revenues.

Property Taxes. Taxes conditioned on ownership of property and measured by its value. Includes general property taxes related to property as a whole, real and personal, tangible or intangible, whether taxes at a single rate or classified rates, and taxes on selected types of property, such as motor vehicles or certain or all intangibles.

Sales and Gross Receipts Taxes. Taxes, including "licenses" at more than nominal rates, based on volume or value of transfers of goods or services; upon gross receipts or gross income; and related taxes based on use, storage, production (other than severance of natural resources), importation, or consumption of goods. Dealer discounts of "commissions" allowed to merchants for collection of taxes form consumers are excluded.

General Sales or Gross Receipts Taxes. Sales or gross receipts taxes which are applicable with only specified exceptions to all types of goods and services, or all gross income, whether at a single rate or at classified rates. Taxes imposed distinctively upon sales or gross receipts from selected commodities, services, or businesses are reported separately under category listed below.

Selective Sales and Gross Receipts Taxes. Sales and gross receipts taxes imposed on particular commodities or services or gross receipts or particular businesses, separately and apart from the application of general sales and gross receipts taxes. Specific taxes on items such as alcoholic beverages or tobacco products are examples.

Charges and Miscellaneous Revenue.

Amounts received from the public for performance of specific services benefiting the person charged, and from sales of commodities and services except by government utilities and liquor stores. Includes fees, assessments, and other reimbursements for current services, rents and sales derived from commodities or services furnished incident to the performance of particular

functions, gross income of commercial activities, and the like. Excludes amounts received from other governments (see *Intergovernmental Revenue*) and interdepartmental charges and transfers. Current charges are distinguished from license taxes, which related to privileges granted by the government or regulatory measures for the protection of the public.

Special Assessments. Compulsory contributions collected from owners of property benefited by special public improvements (street paving, sidewalks, sewer lines, etc.) to defray the cost of such improvements (either directly or through payment of debt service on indebtedness incurred to finance the improvements) and apportioned according to the assumed benefits to the property affected by the improvements.

Utility, Liquor Store, and Insurance Trust Revenue.

Insurance Trust System. A government-administered program for employee retirement and social insurance protection relating to unemployment compensation, workmen's compensation, Old Age, Survivors', Disability, and Health Insurance, and the like.

Insurance Trust Revenue. Comprises amounts form contributions required of employers and employees for financing these social insurance programs, and earnings on assets of such systems.

Liquor Store Revenue. Amounts received from sale of liquor by government liquor stores and other revenues from government liquor store operations. Excludes any taxes collected by government liquor monopoly systems.

Utility Revenue. Revenue from sale of utility commodities and services to the public and to other governments. Does not include amounts from sales to the parent government. Also excludes income from utility fund investments and from other nonoperating properties (treated as general revenue). Any revenue from taxes, special assessments, and intergovernmental aid is classified as general revenue, not utility revenue.

General Expenditure.

All government expenditure other than the specifically enumerated kinds of expenditure classified as utility expenditure, liquor stores expenditure, and employee-retirement insurance trust expenditure.

Education Expenditures.

Provision or support of schools and facilities for elementary and secondary, higher and other education, and libraries. *Elementary and Secondary Education* includes the provision of public kindergarten through high school education by state and local governments. It encompasses instructional, support, and auxiliary services (school lunch, student activities, and community services) offered by public school systems. Revenues and expenditures for enterprise activities are included on a gross basis. *Higher Education* consists of all state and local institutions of higher education. Excluded are agricultural experiment stations and agricultural extension services (included under *Natural Resources*), university-operated hospitals (included under Hospitals), and scholarship and fellowship payments (included under *Other Education*). *Other*

Education includes all Federal Government educational activities with the exception of service academies (which are classified as part of *National Defense and International Relations*), state government and administrative supervision of elementary and secondary and higher education, scholarship and fellowship payments, aid to private schools, and support of special schools for deaf, blind, and other handicapped persons. *Libraries* consist of the establishment and operation of public libraries and support of privately operated libraries (excluding those operated as part of a school system, primarily for the benefit of students and teachers, and law libraries).

Health and Hospital Expenditures.

Health. Out-patient health services, other than hospital care, including: public health administration; research and education; categorical health programs; treatment and immunization clinics; nursing; environmental health activities such as air and water pollution control; ambulance service if provided separately from fire protection services; and other general public health activities such as mosquito abatement. School health services provided by health agencies (rather than school agencies) are included here. Sewage treatment operations are classified under *Sewerage*.

Hospitals. Financing, construction, acquisition, maintenance or operation of hospital facilities, provision of hospital care, and support of public or private hospitals. Includes expenditures by public hospitals under welfare programs for medical assistance such as medicaid. However, see *Public Welfare* concerning vendor payments under welfare programs.

Transportation Expenditures.

Comprises the functions of *Highways*, *Air Transportation*, *Parking Facilities*, *Water Transport and Terminals*, and *Transit Subsidies*.

Air Transportation. Construction, maintenance, operation, and support of airport facilities.

Highways. Construction, maintenance, and operation of highways, streets, and related structures, including toll highways, bridges, tunnels, ferries, street lighting, and snow and ice removal. However, highway policing and traffic control are classed under *Police Protection*.

Parking Facilities. Construction, purchase, maintenance, and operation of public-use parking lots, garages, parking meters, and other distinctive parking facilities on a commercial basis. Applies only to local governments.

Transit Subsidies. Payments in support of subway, bus, surface rail and street railroad, and other passenger transportation systems, including public support of a private utility or railroad and intergovernmental subsidy payments. Excludes amounts paid by a parent government to its dependent transit utility. Also see under *Utility*.

Water Transport and Terminals. Construction, maintenance, operation, and support of canals and other waterways, harbors, docks, wharves, and related marine terminal facilities.

Police Protection and Corrections Expenditures.

Correction. Confinement and correction of adults and minors convicted of offenses against the law, and pardon, probation, and parole activities.

Police Protection. Preservation of law and order and traffic safety. Includes police patrols and communications, crime prevention activities, detention and custody of persons awaiting trial, traffic safety, and vehicular inspection.

Fire Protection Expenditures.

Fire fighting organization and auxiliary services; fire inspection and investigation; support of volunteer fire forces; and other fire prevention activities. Includes cost of fire fighting facilities, such as fire hydrants and water, furnished by other agencies of the government.

Natural Resources, Parks, and Recreation Expenditures.

Natural Resources. Conservation, promotion, and development of natural resources, such as soil, water, forests, minerals, and wildlife. Includes irrigation, drainage, flood control, forestry and forest protection, soil reclamation, soil and water conservation, fish and game programs, and agricultural fairs. For the Federal Government, includes agricultural experiment stations and extension services, farm price stabilization programs, farm insurance and credit activities, and multipurpose power and reclamation projects.

Parks and Recreation. Provision and support of recreational and cultural-scientific facilities and activities including golf courses, playfields, playgrounds, public beaches, swimming pools, tennis courts, parks, auditoriums, stadiums, auto camps, recreation piers, botanical gardens, galleries, museums, and zoos. Also includes building and operation of convention centers and exhibition halls.

Public Welfare, Housing, and Community Development Expenditures.

Housing and Community Development. Construction and operation of housing and redevelopment projects, and other activities to promote or aid housing and community development.

Public Welfare. Support of and assistance to needy persons contingent upon their need. Excludes pensions to former employees and other benefits not contingent on need. Expenditures under this heading include *Cash Assistance* paid to needy persons under the Federal categorical programs (Supplemental Security Income and Age Assistance Aid to Families With Dependent Children) and under any other welfare programs; *Vendor Payments* made directly to private purveyors for medical care, burials, and other commodities and services provided under welfare programs; and provision and operation by the government of *Welfare Institutions*. *Other Public Welfare* includes payments to other governments for welfare purposes, amounts for administration, support of private welfare agencies, and other public welfare services. Health and Hospital services including those under public welfare programs like Medicaid, provided

directly by the government through its own hospitals and health agencies, and any payments to other governments for such purposes are classed under those functional headings rather than here.

Sewerage and Sanitation Expenditures.

Sewerage. Provision of sanitary and storm sewers and sewage disposal facilities and services, and payments to other governments for such purposes.

Sanitation. Street cleaning, solid waste collection and disposal, and provision of sanitary landfills. Sanitary engineering, smoke regulation, and other health activities are classified under *Health*.

Government Finance, Administration, General, and Debt Interest Expenditures.

Financial Administration. Officials and agencies concerned with tax assessment and collection, accounting, auditing, budgeting, purchasing, custody of funds, and other finance activities.

Government Administration. Comprises to functions of Financial Administration, Judicial and Legal, and General Public Buildings; and activities of the governing body, office of the chief executive, and central staff services and agencies concerned with personnel administration, recording, planning, zoning, and the like.

Interest Expenditure. Amounts paid for the use of borrowed money. Interest on utility debt is included in *Utility Expenditure*.

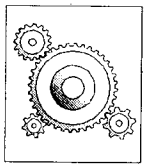
Utility, Liquor Store, and Insurance Trust Expenditures.

Insurance Trust Expenditure. Corresponds with the character and object category, *Insurance Benefits and Repayments*, and comprises only cash payments to beneficiaries (including withdrawals of contributions). These categories exclude costs of administering insurance trust systems, which are classed as general expenditure. Insurance trust revenue and expenditure do not include any contributions to government to a system it administers. Any amounts paid by a government as employer contributions to an insurance trust system administered by another government are classed as general expenditure for current operation, and as insurance trust revenue of the particular system and receiving government.

Insurance Benefits and Repayments. Social insurance payments to beneficiaries, employee-retirement annuities and other benefits, and withdrawals of insurance or employee-retirement contributions. Includes only amounts paid to beneficiaries; administrative expenditure for such activities are classified as *Current Operation*.

Liquor Store Expenditures. Expenditures for purchase of liquor for resale and provision and operation of liquor stores. Excludes expenditure for law enforcement and licensing activities carried out in conjunction with liquor store operations.

Utility Expenditures. Expenditure for construction of utility facilities or equipment, for production and distribution of utility commodities and services (except those furnished to parent government), and for interest on utility debt. Does not include expenditure in connection with administration of utility debt and investments (treated as general expenditure) and the cost of providing services to the parent government (such costs, when identifiable, are treated as expenditure for the function served).



APPENDIX D
TSP PROGRAM AND STATISTICAL RUNS FOR THE LPFI MODEL

TSP Version 4.2A
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In case of questions or problems, see your local TSP consultant or send a description of the problem and the associated TSP output to:

TSP International
P.O. Box 61015, Station A
Palo Alto, CA 94306
USA

PROGRAM

```
LINE  ************************************************************************

   1  smpl 1 3092;
   2  ?
   2  load (file='c:\findata\revdat.abs',format=free)
   2  fips rv201 rv202 rv203 rv204 rv205 rv206 rv207 rv208 rv209
   2  tax82 rv701 rv702 rv703 rv704 rv705 rv706 rv707 rv708 rv709
   2  tax87;
   3  close (file='c:\findata\revdat.abs');
   4  load (file='c:\findata\revdat.avg',format=free)
   4  mfips mrv201 mrv202 mrv203 mrv204 mrv205 mrv206 mrv207 mrv208
   4  mrv209 mtax82 mrv701 mrv702 mrv703 mrv704 mrv705 mrv706 mrv707
   4  mrv708 mrv709 mtax87;
   5  close (file='c:\findata\revdat.avg');
   6  ?
   6  load (file='c:\findata\expdat.abs',format=free)
   6  xfips ex201 ex202 ex203 ex204 ex205 ex206 ex207 ex208 ex209 ex210
   6  ex211 ex701 ex702 ex703 ex704 ex705 ex706 ex707 ex708 ex709 ex710
   6  ex711;
   7  close (file='c:\findata\expdat.abs');
   8  load (file='c:\findata\expdat.avg',format=free)
   8  mxfips mex201 mex202 mex203 mex204 mex205 mex206 mex207 mex208
   8  mex209 mex210 mex211 mex701 mex702 mex703 mex704 mex705 mex706
   8  mex707 mex708 mex709 mex710 mex711;
   9  close (file='c:\findata\expdat.avg');
  10  ?
  10  load (file='c:\findata\mondat.abs',format=free)
  10  monreg inc80 inc82 inc87 pop80 pop82 pop87 inpp80 inpp82 inpp87
  10  faminc hval rval;
  11  close (file='c:\findata\mondat.abs');
  12  load (file='c:\findata\mondat.avg',format=free)
  12  mmonreg minc80 minc82 minc87 mpop80 mpop82 mpop87 minpp80 minpp82
```

```
12  minpp87 mfaminc mhval mrval;
13  close (file='c:\findata\mondat.avg');
14  ?
14  load (file='c:\findata\perdat.abs',format=free)
14  perreg medage young old teent teenm white black marry divor urban
14  vacant renth rentp unemp femc hard idle pov1 pov2;
15  close (file='c:\findata\perdat.abs');
16  load (file='c:\findata\perdat.avg',format=free)
16  mperreg mmedage myoung mold mteent mteenm mwhite mblack mmarry
16  mdivor murban mvacant mrenth mrentp munemp mfemc mhard midle
16  mpov1 mpov2;
17  close (file='c:\findata\perdat.avg');
18  ?
18  load (file='c:\findata\educ.dat',format=free)
18  edreg kids high coll mkids mhigh mcoll;
19  close (file='c:\findata\educ.dat');
20  load (file='c:\findata\other.dat',format=free)
20  otreg den pov mden mpov;
21  close (file='c:\findata\other.dat');
22  ?
22  d01 = (fips>01000 & fips<01999); d02 = (fips>02000 & fips<02999);
24  d04 = (fips>04000 & fips<04999); d05 = (fips>05000 & fips<05999);
26  d06 = (fips>06000 & fips<06999); d08 = (fips>08000 & fips<08999);
28  d09 = (fips>09000 & fips<09999); d10 = (fips>10000 & fips<10999);
30  d11 = (fips>11000 & fips<11999); d12 = (fips>12000 & fips<12999);
32  d13 = (fips>13000 & fips<13999); d15 = (fips>15000 & fips<15999);
34  d16 = (fips>16000 & fips<16999); d17 = (fips>17000 & fips<17999);
36  d18 = (fips>18000 & fips<18999); d19 = (fips>19000 & fips<19999);
38  d20 = (fips>20000 & fips<20999); d21 = (fips>21000 & fips<21999);
40  d22 = (fips>22000 & fips<22999); d23 = (fips>23000 & fips<23999);
42  d24 = (fips>24000 & fips<24999); d25 = (fips>25000 & fips<25999);
44  d26 = (fips>26000 & fips<26999); d27 = (fips>27000 & fips<27999);
46  d28 = (fips>28000 & fips<28999); d29 = (fips>29000 & fips<29999);
48  d30 = (fips>30000 & fips<30999); d31 = (fips>31000 & fips<31999);
50  d32 = (fips>32000 & fips<32999); d33 = (fips>33000 & fips<33999);
52  d34 = (fips>34000 & fips<34999); d35 = (fips>35000 & fips<35999);
54  d36 = (fips>36000 & fips<36999); d37 = (fips>37000 & fips<37999);
56  d38 = (fips>38000 & fips<38999); d39 = (fips>39000 & fips<39999);
58  d40 = (fips>40000 & fips<40999); d41 = (fips>41000 & fips<41999);
60  d42 = (fips>42000 & fips<42999); d44 = (fips>44000 & fips<44999);
62  d45 = (fips>45000 & fips<45999); d46 = (fips>46000 & fips<46999);
64  d47 = (fips>47000 & fips<47999); d48 = (fips>48000 & fips<48999);
66  d49 = (fips>49000 & fips<49999); d50 = (fips>50000 & fips<50999);
68  d51 = (fips>51000 & fips<51999); d53 = (fips>53000 & fips<53999);
70  d54 = (fips>54000 & fips<54999); d55 = (fips>55000 & fips<55999);
72  d56 = (fips>56000 & fips<56999);
73  ?
73  ?d02 d04 d05 d06 d08 d09 d10 d11 d12 d13 d15 d16 d17 d18 d19 d20
73  ?d21 d22 d23 d24 d25 d26 d27 d28 d29 d30 d31 d32 d33 d34 d35 d36
73  ?d37 d38 d39 d40 d41 d42 d44 d45 d46 d47 d48 d49 d50 d51 d53 d54
73  ?d55 d56
73  ?
73  ?c minpp82 munemp mhard midle mpov mvacant mrentp mhval mrval
73  ?mmedage mteent mmarry mdivor mblack mwhite mfemc mhigh mcoll
73  ?murban mden myoung mold
73  ?
73  genr prv02=0; genr prv03=0; genr prv04=0; genr prv08=0;
77  genr prv09=0; genr ptax=0;
79  genr pex02=0; genr pex03=0; genr pex04=0; genr pex05=0;
83  genr pex06=0; genr pex07=0; genr pex08=0; genr pex09=0;
87  genr pex10=0; genr pex11=0;
```

```
 89  ?
 89  ? Federal Transfers (rev02)
 89  select rv702>0;
 90  olsq rv702 c rv202 rv203 high den black white unemp
 90  d02 d04 d05 d06 d08 d09 d10 d11 d12 d13 d15 d16 d17 d18 d19 d20
 90  d21 d22 d23 d24 d25 d26 d27 d28 d29 d30 d31 d32 d33 d34 d35 d36
 90  d37 d38 d39 d40 d41 d42 d44 d45 d46 d47 d48 d49 d50 d51 d53 d54
 90  d55 d56;
 91  prv02=@fit;
 92  ?
 92  ? State Transfers (rev03)
 92  select rv703>0;
 93  olsq rv703 c rv203 rv202 inpp82 pov1 den pop82 white hard
 93  d02 d04 d05 d06 d08 d09 d10 d11 d12 d13 d15 d16 d17 d18 d19 d20
 93  d21 d22 d23 d24 d25 d26 d27 d28 d29 d30 d31 d32 d33 d34 d35 d36
 93  d37 d38 d39 d40 d41 d42 d44 d45 d46 d47 d48 d49 d50 d51 d53 d54
 93  d55 d56;
 94  prv03=@fit;
 95  ?
 95  ? Taxes (tax as a percent of income)
 95  select tax87>0;
 96  list ivar tax82 mtax82 inpp82 white minpp82 mwhite
 96  c munemp mhard midle mpov mvacant mrentp mhval mrval
 96  mmedage mteent mmarry mdivor mblack mfemc mhigh mcoll
 96  murban mden myoung mold
 96  d02 d04 d05 d06 d08 d09 d10 d11 d12 d13 d15 d16 d17 d18 d19 d20
 96  d21 d22 d23 d24 d25 d26 d27 d28 d29 d30 d31 d32 d33 d34 d35 d36
 96  d37 d38 d39 d40 d41 d42 d44 d45 d46 d47 d48 d49 d50 d51 d53 d54
 96  d55 d56;
 97  2sls (inst=ivar) tax87 c tax82 mtax87 mtax82 inpp82 white
 97  d02 d04 d05 d06 d08 d09 d10 d11 d12 d13 d15 d16 d17 d18 d19 d20
 97  d21 d22 d23 d24 d25 d26 d27 d28 d29 d30 d31 d32 d33 d34 d35 d36
 97  d37 d38 d39 d40 d41 d42 d44 d45 d46 d47 d48 d49 d50 d51 d53 d54
 97  d55 d56;
 98  ptax=@fit;
 99  ?
 99  ? Charges & Misc Revenue (rev08)
 99  select rv708>0;
100  olsq rv708 c rv208 tax82 high white inpp82
100  d02 d04 d05 d06 d08 d09 d10 d11 d12 d13 d15 d16 d17 d18 d19 d20
100  d21 d22 d23 d24 d25 d26 d27 d28 d29 d30 d31 d32 d33 d34 d35 d36
100  d37 d38 d39 d40 d41 d42 d44 d45 d46 d47 d48 d49 d50 d51 d53 d54
100  d55 d56;
101  prv08=@fit;
102  ?
102  ? Utility Revenue (rev09)
102  select rv709>0;
103  olsq rv709 c rv209 den
103  d02 d04 d05 d06 d08 d09 d10 d11 d12 d13 d15 d16 d17 d18 d19 d20
103  d21 d22 d23 d24 d25 d26 d27 d28 d29 d30 d31 d32 d33 d34 d35 d36
103  d37 d38 d39 d40 d41 d42 d44 d45 d46 d47 d48 d49 d50 d51 d53 d54
103  d55 d56;
104  prv09=@fit;
105  ?
105  ? Education Expenditures (exp02)
105  select ex702>0;
106  list ivar ex202 mex202 rv201 coll urban den hval mrv201 mcoll
106  murban mden mhval
106  c minpp82 munemp mhard midle mpov mvacant mrentp mrval
106  mmedage mteent mmarry mdivor mblack mwhite mfemc mhigh myoung mold
106  d02 d04 d05 d06 d08 d09 d10 d11 d12 d13 d15 d16 d17 d18 d19 d20?
```

```
106  d21 d22 d23 d24 d25 d26 d27 d28 d29 d30 d31 d32 d33 d34 d35 d36
106  d37 d38 d39 d40 d41 d42 d44 d45 d46 d47 d48 d49 d50 d51 d53 d54
106  d55 d56;
107  2sls (inst=ivar) ex702 c ex202 mex702 mex202 rv201 coll
107  urban den hval
107  d02 d04 d05 d06 d08 d09 d10 d11 d12 d13 d15 d16 d17 d18 d19 d20
107  d21 d22 d23 d24 d25 d26 d27 d28 d29 d30 d31 d32 d33 d34 d35 d36
107  d37 d38 d39 d40 d41 d42 d44 d45 d46 d47 d48 d49 d50 d51 d53 d54
107  d55 d56;
108  pex02=@fit;
109  ?
109  ? Health Expenditures (exp03)
109  select ex703>0;
110  list ivar ex203 mex203 rv201 inpp82 unemp den mrv201 minpp82
110  munemp mden
110  c mhard midle mpov mvacant mrentp mhval mrval mmedage mteent
110  mmarry mdivor mblack mwhite mfemc mhigh mcoll murban myoung mold
110  d02 d04 d05 d06 d08 d09 d10 d11 d12 d13 d15 d16 d17 d18 d19 d20
110  d21 d22 d23 d24 d25 d26 d27 d28 d29 d30 d31 d32 d33 d34 d35 d36
110  d37 d38 d39 d40 d41 d42 d44 d45 d46 d47 d48 d49 d50 d51 d53 d54
110  d55 d56;
111  2sls (inst=ivar) ex703 c ex203 mex703 mex203 rv201 inpp82 unemp
111  den
111  d02 d04 d05 d06 d08 d09 d10 d11 d12 d13 d15 d16 d17 d18 d19 d20
111  d21 d22 d23 d24 d25 d26 d27 d28 d29 d30 d31 d32 d33 d34 d35 d36
111  d37 d38 d39 d40 d41 d42 d44 d45 d46 d47 d48 d49 d50 d51 d53 d54
111  d55 d56;
112  pex03=@fit;
113  ?
113  ? Transportation Expenditures (exp04)
113  select ex704>0;
114  list ivar ex204 mex204 rv201 medage urban inpp82
114  mrv201 mmedage murban mblack mwhite minpp82
114  c munemp mhard midle mpov mvacant mrentp mhval mrval mteent
114  mmarry mdivor mfemc mhigh mcoll mden myoung mold
114  d02 d04 d05 d06 d08 d09 d10 d11 d12 d13 d15 d16 d17 d18 d19 d20
114  d21 d22 d23 d24 d25 d26 d27 d28 d29 d30 d31 d32 d33 d34 d35 d36
114  d37 d38 d39 d40 d41 d42 d44 d45 d46 d47 d48 d49 d50 d51 d53 d54
114  d55 d56;
115  2sls (inst=ivar) ex704 c ex204 mex704 mex204 rv201 medage urban
115  inpp82
115  d02 d04 d05 d06 d08 d09 d10 d11 d12 d13 d15 d16 d17 d18 d19 d20
115  d21 d22 d23 d24 d25 d26 d27 d28 d29 d30 d31 d32 d33 d34 d35 d36
115  d37 d38 d39 d40 d41 d42 d44 d45 d46 d47 d48 d49 d50 d51 d53 d54
115  d55 d56;
116  pex04=@fit;
117  ?
117  ? Police Expenditures (exp05)
117  select ex705>0;
118  olsq ex705 c ex205 mex205 rv201 young old inpp82 vacant high den
118  divor
118  d02 d04 d05 d06 d08 d09 d10 d11 d12 d13 d15 d16 d17 d18 d19 d20
118  d21 d22 d23 d24 d25 d26 d27 d28 d29 d30 d31 d32 d33 d34 d35 d36
118  d37 d38 d39 d40 d41 d42 d44 d45 d46 d47 d48 d49 d50 d51 d53 d54
118  d55 d56;
119  pex05=@fit;
120  ?
120  ? Fire Protection Expenditures (exp06)
120  select ex706>0;
121  olsq ex706 c ex206 rv201 black white inpp82 vacant coll urban den
121  d02 d04 d05 d06 d08 d09 d10 d11 d12 d13 d15 d16 d17 d18 d19 d20
```

```
d21 d22 d23 d24 d25 d26 d27 d28 d29 d30 d31 d32 d33 d34 d35 d36
d37 d38 d39 d40 d41 d42 d44 d45 d46 d47 d48 d49 d50 d51 d53 d54
d55 d56;
pex06=@fit;
?
? Parks & Recreation Expenditures (exp07)
select ex707>0;
list ivar ex207 mex207 rv201 inpp82 mrv201 minpp82
c munemp mhard midle mpov mvacant mrentp mhval mrval mmedage
mteent mmarry mdivor mblack mwhite mfemc mhigh mcoll murban mden
myoung mold
d02 d04 d05 d06 d08 d09 d10 d11 d12 d13 d15 d16 d17 d18 d19 d20
d21 d22 d23 d24 d25 d26 d27 d28 d29 d30 d31 d32 d33 d34 d35 d36
d37 d38 d39 d40 d41 d42 d44 d45 d46 d47 d48 d49 d50 d51 d53 d54
d55 d56;
2sls (inst=ivar) ex707 c ex207 mex707 mex207 rv201 inpp82
d02 d04 d05 d06 d08 d09 d10 d11 d12 d13 d15 d16 d17 d18 d19 d20
d21 d22 d23 d24 d25 d26 d27 d28 d29 d30 d31 d32 d33 d34 d35 d36
d37 d38 d39 d40 d41 d42 d44 d45 d46 d47 d48 d49 d50 d51 d53 d54
d55 d56;
pex07=@fit;
?
? Welfare & Housing Expenditures (exp08)
select ex708>0;
olsq ex708 c ex208 rv201 idle den rentp vacant unemp
d02 d04 d05 d06 d08 d09 d10 d11 d12 d13 d15 d16 d17 d18 d19 d20
d21 d22 d23 d24 d25 d26 d27 d28 d29 d30 d31 d32 d33 d34 d35 d36
d37 d38 d39 d40 d41 d42 d44 d45 d46 d47 d48 d49 d50 d51 d53 d54
d55 d56;
pex08=@fit;
?
? Sanitation Expenditures (exp09)
select ex709>0;
olsq ex709 c ex209 rv201 rentp coll urban black white den hval
d02 d04 d05 d06 d08 d09 d10 d11 d12 d13 d15 d16 d17 d18 d19 d20
d21 d22 d23 d24 d25 d26 d27 d28 d29 d30 d31 d32 d33 d34 d35 d36
d37 d38 d39 d40 d41 d42 d44 d45 d46 d47 d48 d49 d50 d51 d53 d54
d55 d56;
pex09=@fit;
?
? Finance & Administration Expenditures (exp10)
select ex710>0;
olsq ex710 c ex210 rv201 inpp82 urban
d02 d04 d05 d06 d08 d09 d10 d11 d12 d13 d15 d16 d17 d18 d19 d20
d21 d22 d23 d24 d25 d26 d27 d28 d29 d30 d31 d32 d33 d34 d35 d36
d37 d38 d39 d40 d41 d42 d44 d45 d46 d47 d48 d49 d50 d51 d53 d54
d55 d56;
pex10=@fit;
?
? Utility Expenditures (exp11)
select ex711>0;
olsq ex711 c ex211 rv201 urban
d02 d04 d05 d06 d08 d09 d10 d11 d12 d13 d15 d16 d17 d18 d19 d20
d21 d22 d23 d24 d25 d26 d27 d28 d29 d30 d31 d32 d33 d34 d35 d36
d37 d38 d39 d40 d41 d42 d44 d45 d46 d47 d48 d49 d50 d51 d53 d54
d55 d56;
pex11=@fit;
?
smpl 1 3092;
genr prv04 = ((ptax/100)*inc87*1000) / pop87;
genr prv01 = prv02 + prv03 + prv04 + prv08 + prv09;
```

```
    142  genr peduc = (young/100)*pex02;
    143  genr pex01 = peduc + pex03 + pex04 + pex05 + pex06 + pex07
    143  + pex08 + pex09 + pex10 + pex11;
    144  write (file='c:\findata\pred.dat',
    144  format='(f6.0,6f12.2,f12.3/6x,7f12.2/6x,4f12.2)')
    144  fips prv01 prv02 prv03 prv04 prv08 prv09 ptax
    144  pex01 pex02 pex03 pex04 pex05 pex06 pex07 pex08 pex09 pex10 pex11;
    145  ?
    145  stop;

         EXECUTION

************************************************************************

Current sample:  1 to 3092
```

Federal Transfers Per Capita

Method of estimation = Ordinary Least Squares

Dependent variable: RV702
Number of observations: 3087
Current sample: 1 to 1744, 1746 to 2636, 2638 to 2657, 2659 to 2665, 2667 to 2723, 2725 to 3092

Mean of dependent variable = 46.6221
Std. dev. of dependent var. = 70.1327
Sum of squared residuals = .803545E+07
Variance of residuals = 2652.84
Std. error of regression = 51.5057
R-squared = .470613
Adjusted R-squared = .460651
Durbin-Watson statistic = 2.18763
F-statistic (zero slopes) = 47.2405
Schwarz Bayes. Info. Crit. = 8.01538
Log of likelihood function = -16519.0

Variable	Estimated Coefficient	Standard Error	t-statistic
C	257.130	20.3131	12.6584
RV202	.218828	.019834	11.0329
RV203	.039043	.695389E-02	5.61452
HIGH	.429361	.132404	3.24280
DEN	.874207E-02	.140348E-02	6.22886
BLACK	-2.69038	.191004	-14.0855
WHITE	-2.81313	.171857	-16.3690
UNEMP	1.43007	.413883	3.45526
D02	-33.3941	20.1678	-1.65581
D04	-33.6541	16.0002	-2.10336
D05	-.461527	8.75909	-.052691
D06	-49.4188	10.6463	-4.64189
D08	-4.82601	9.99355	-.482913
D09	-16.0167	19.5445	-.819498
D10	-14.2525	30.4809	-.467586
D11	1274.72	65.6394	19.4201
D12	2.69986	9.11492	.296202
D13	.107598	7.58921	.014178
D15	-170.894	29.1169	-5.86923
D16	-13.3485	10.7604	-1.24052
D17	-5.08197	8.61267	-.590058
D18	-12.0028	8.83215	-1.35898
D19	-5.79854	8.89003	-.652253
D20	-1.01379	8.76423	-.115674
D21	-9.09112	8.29978	-1.09535
D22	-10.1841	9.06470	-1.12350
D23	3.95038	14.7520	.267785
D24	7.67015	12.4010	.618510
D25	34.4005	15.6886	2.19271
D26	-3.20264	9.40113	-.340665
D27	4.30988	9.44903	.456119
D28	-2.60320	8.55783	-.304189
D29	.149152	8.34611	.017871
D30	37.2654	10.0339	3.71394
D31	-13.4330	9.00161	-1.49229
D32	-2.66610	15.1778	-.175657
D33	7.94535	17.8199	.445869
D34	-24.5952	13.4029	-1.83506

D35	-54.8673	12.3721	-4.43475
D36	-15.0616	10.1802	-1.47951
D37	-2.87353	8.18805	-.350942
D38	20.6783	10.1753	2.03221
D39	.582757	8.90564	.065437
D40	-24.8618	9.24130	-2.69029
D41	21.0178	11.5313	1.82267
D42	-9.19297	9.43422	-.974429
D44	4.73797	24.1331	.196326
D45	-5.29366	9.93217	-.532981
D46	10.6796	9.65070	1.10661
D47	-5.12134	8.52115	-.601015
D48	-14.6684	7.66077	-1.91474
D49	11.1388	12.2358	.910351
D50	5.12376	15.5283	.329963
D51	-9.60524	8.13951	-1.18008
D53	33.8332	11.3844	2.97190
D54	-4.57579	9.79216	-.467291
D55	-20.4353	9.53507	-2.14318
D56	-4.00786	13.3251	-.300776

State and Local Transfers Per Capita

Method of estimation = Ordinary Least Squares

Dependent variable: RV703
Number of observations: 3091
Current sample: 1 to 305, 307 to 3092

Mean of dependent variable = 434.142
Std. dev. of dependent var. = 217.714
Sum of squared residuals = .240912E+08
Variance of residuals = 7945.66
Std. error of regression = 89.1384
R-squared = .835514
Adjusted R-squared = .832368
Durbin-Watson statistic = 2.09527
F-statistic (zero slopes) = 265.538
Schwarz Bayes. Info. Crit. = 9.11450
Log of likelihood function = -18235.3

Variable	Estimated Coefficient	Standard Error	t-statistic
C	47.5548	27.0574	1.75755
RV203	.762232	.012074	63.1283
RV202	.080109	.033977	2.35772
INPP82	-.980252E-02	.112897E-02	-8.68274
POV1	1.13978	.241885	4.71206
DEN	.023165	.267262E-02	8.66766
POP82	-.262861E-04	.809053E-05	-3.24899
WHITE	.511605	.171186	2.98858
HARD	.894487	.235093	3.80482
D02	-275.862	33.3552	-8.27045
D04	148.016	26.3771	5.61152
D05	5.79639	15.1317	.383062
D06	242.321	17.4654	13.8744
D08	87.7324	16.4499	5.33331
D09	76.2320	33.9551	2.24508
D10	73.4702	52.7583	1.39258
D11	.000000	.000000	.000000
D12	71.6338	15.6439	4.57903
D13	123.288	13.0334	9.45944
D15	-8.38260	46.6069	-.179857
D16	89.7736	17.7988	5.04380
D17	13.1741	14.6600	.898645
D18	48.9967	14.9411	3.27933
D19	50.1322	14.9254	3.35886
D20	74.0659	14.7220	5.03098
D21	-2.36305	14.1462	-.167045
D22	-72.9374	15.7144	-4.64144
D23	21.5722	25.3193	.852007
D24	3.15944	21.5668	.146495
D25	121.791	27.0562	4.50140
D26	58.5088	15.3664	3.80758
D27	199.315	15.8435	12.5802
D28	17.4055	14.8274	1.17387
D29	-5.69763	14.2574	-.399627
D30	-18.1071	16.7025	-1.08409
D31	-12.7474	15.0029	-.849663
D32	143.560	25.2601	5.68326
D33	-42.1774	30.7191	-1.37300
D34	56.6851	23.5291	2.40915

D35	93.1709	19.8333	4.69771
D36	117.553	17.3086	6.79162
D37	62.1812	14.1667	4.38924
D38	-13.7352	17.1688	-.800009
D39	62.3642	15.0488	4.14414
D40	-5.29203	15.3835	-.344008
D41	-32.3891	19.1217	-1.69384
D42	24.9310	16.1526	1.54347
D44	-26.3955	41.7700	-.631925
D45	-1.06227	17.1509	-.061936
D46	-38.4490	15.8306	-2.42878
D47	3.34941	14.6152	.229173
D48	49.6505	12.6192	3.93453
D49	35.3017	20.4584	1.72553
D50	45.1528	26.6485	1.69438
D51	64.1298	14.1146	4.54350
D53	124.163	18.8715	6.57941
D54	15.6064	16.8122	.928274
D55	78.1547	16.0068	4.88261
D56	277.055	22.5604	12.2806

*** WARNING in line 93 Procedure OLSQ: At least one coefficient in the table above could not be estimated due to singularity of the data.

Tax Rate

Method of estimation = Instrumental Variable

Instrumental variables: TAX82 MTAX82 INPP82 WHITE MINPP82 MWHITE C MUNEMP MHARD MIDLE MPOV MVACANT MRENTP MHVAL MRVAL MMEDAGE MTEENT MMARRY MDIVOR MBLACK MFEMC MHIGH MCOLL MURBAN MDEN MYOUNG MOLD D02 D04 D05 D06 D08 D09 D10 D11 D12 D13 D15 D16 D17 D18 D19 D20 D21 D22 D23 D24 D25 D26 D27 D28 D29 D30 D31 D32 D33 D34 D35 D36 D37 D38 D39 D40 D41 D42 D44 D45 D46 D47 D48 D49 D50 D51 D53 D54 D55 D56

Dependent variable: TAX87
Number of observations: 3092
Current sample: 1 to 3092

Mean of dependent variable = 3.89064
Std. dev. of dependent var. = 2.50350
Sum of squared residuals = 3210.15
Variance of residuals = 1.05736
Std. error of regression = 1.02828

R-squared = .834654
Adjusted R-squared = .831659
Durbin-Watson statistic = 1.97465
F-statistic (zero slopes) = 277.926
E'PZ*E = 72.5673

Variable	Estimated Coefficient	Standard Error	t-statistic
C	.040114	.188378	.212945
TAX82	.932507	.011578	80.5433
MTAX87	.812972	.103010	7.89220
MTAX82	-.791579	.103316	-7.66171
INPP82	.469499E-04	.114302E-04	4.10755
WHITE	-.382454E-02	.172466E-02	-2.21757
D02	.010231	.294896	.034693
D04	.455836	.304499	1.49701
D05	.037274	.174237	.213929
D06	-.021807	.190806	-.114289
D08	.438792	.240766	1.82248
D09	-.062256	.392965	-.158426
D10	-.285924	.608252	-.470075
D11	2.68495	1.04990	2.55733
D12	.091634	.180748	.506971
D13	-.019421	.150712	-.128865
D15	-.424420	.537312	-.789895
D16	.186016	.206166	.902263
D17	-.101198	.173928	-.581839
D18	.056379	.172724	.326412
D19	.104197	.174098	.598497
D20	.191563	.178702	1.07197
D21	.078663	.162472	.484162
D22	.068830	.189090	.364006
D23	.072027	.292344	.246376
D24	-.164722	.249088	-.661299
D25	-.229629	.314312	-.730578
D26	.047813	.186485	.256388
D27	.252241	.176713	1.42741
D28	.040560	.171452	.236568
D29	-.087833	.167848	-.523291
D30	.313694	.211076	1.48617
D31	.183197	.180902	1.01269
D32	.612537	.284525	2.15285
D33	-.152464	.356306	-.427903
D34	-.239869	.268601	-.893032

D35	.170791	.221748	.770201
D36	.163147	.199375	.818294
D37	.112659	.164377	.685371
D38	-.039709	.196777	-.201796
D39	.039241	.174147	.225331
D40	-.073730	.180168	-.409228
D41	.100693	.221038	.455548
D42	.137767	.185308	.743448
D44	-.014761	.484913	-.030440
D45	.247189E-02	.198542	.012450
D46	.085366	.191252	.446352
D47	.041498	.168333	.246521
D48	.254685	.180883	1.40801
D49	.360428	.268380	1.34298
D50	.499429	.311033	1.60571
D51	-.038035	.162895	-.233493
D53	-.029750	.213224	-.139526
D54	.052099	.192978	.269975
D55	.157835	.184701	.854539
D56	.660093	.268861	2.45515

Charges and Miscellaneous Per Capita

Method of estimation = Ordinary Least Squares

Dependent variable: RV708
Number of observations: 3092
Current sample: 1 to 3092

Mean of dependent variable = 281.459
Std. dev. of dependent var. = 269.492
Sum of squared residuals = .131703E+09
Variance of residuals = 43380.3
Std. error of regression = 208.279
R-squared = .413318
Adjusted R-squared = .402690
Durbin-Watson statistic = 2.03822
F-statistic (zero slopes) = 38.8884
Schwarz Bayes. Info. Crit. = 10.8050
Log of likelihood function = -20866.9

Variable	Estimated Coefficient	Standard Error	t-statistic
C	33.9676	41.1861	.824733
RV208	.683134	.019807	34.4887
TAX82	11.8446	2.23230	5.30601
HIGH	1.25399	.592196	2.11753
WHITE	-1.65582	.351210	-4.71463
INPP82	.011338	.282930E-02	4.00752
D02	-55.3673	59.2614	-.934290
D04	93.4330	62.0198	1.50650
D05	6.17075	35.3187	.174716
D06	12.7421	39.0388	.326394
D08	82.0053	39.3178	2.08570
D09	-115.078	79.4412	-1.44859
D10	-27.6524	123.205	-.224442
D11	-114.470	212.565	-.538520
D12	28.5381	36.4669	.782576
D13	45.0930	30.6156	1.47288
D15	-201.659	108.852	-1.85260
D16	-17.6925	42.3259	-.418008
D17	-39.9191	34.4887	-1.15746
D18	39.5280	35.0907	1.12645
D19	-20.7367	35.4113	-.585596
D20	-6.11626	35.4337	-.172612
D21	92.5698	33.1854	2.78947
D22	-6.89495	36.6200	-.188284
D23	-62.3297	59.4846	-1.04783
D24	-82.0767	50.5168	-1.62474
D25	-89.3706	63.0152	-1.41824
D26	-28.1836	36.5899	-.770256
D27	76.4039	35.6381	2.14389
D28	29.4640	34.4979	.854081
D29	-10.4794	33.2711	-.314971
D30	-13.9789	41.5876	-.336131
D31	-50.0371	36.2497	-1.38035
D32	70.6872	57.5868	1.22749
D33	-88.7597	72.3024	-1.22762
D34	-53.3032	54.1486	-.984387
D35	37.2667	45.2569	.823446
D36	5.45288	40.1174	.135923
D37	-12.6327	33.0527	-.382199

D38	-36.8172	39.5092	-.931863
D39	-25.2158	35.4468	-.711371
D40	-48.2683	35.5411	-1.35810
D41	-37.0243	45.2576	-.818079
D42	4.35066	37.5767	.115781
D44	-109.511	97.5947	-1.12210
D45	.946093	40.0615	.023616
D46	-91.2303	37.8807	-2.40836
D47	-15.0455	34.1339	-.440778
D48	9.67399	30.2373	.319935
D49	10.2039	49.2648	.207123
D50	-92.0681	62.9061	-1.46358
D51	-53.4031	33.3190	-1.60278
D53	3.90674	43.6116	.089580
D54	48.9314	38.9900	1.25497
D55	-48.4867	37.4650	-1.29419
D56	10.0775	54.2027	.185922

Utility Revenues Per Capita

Method of estimation = Ordinary Least Squares

Dependent variable: RV709
Number of observations: 3041
Current sample: 1 to 69, 71 to 80, 82 to 89, 91 to 174, 176 to 477, 479 to 958, 960 to 974, 976 to 1016, 1018 to 1041, 1043 to 1078, 1080 to 1101, 1103 to 1216, 1218 to 1224, 1226 to 1232, 1234 to 1282, 1284 to 1604, 1606 to 1621, 1623 to 1640, 1643 to 1672, 1674 to 1689, 1691 to 1694, 1698 to 1729, 1731 to 1743, 1745 to 1780, 1782 to 1804, 1806 to 2313, 2315 to 2348, 2350 to 2525, 2527 to 2588, 2590 to 2623, 2625 to 2632, 2634 to 2636, 2638 to 2652, 2654 to 2698, 2700 to 2802, 2804 to 2807, 2809 to 2809, 2811 to 2821, 2823 to 2823, 2825 to 2829, 2831 to 2837, 2839 to 2846, 2849 to 2855, 2857 to 2859, 2861 to 2862, 2864 to 2868, 2870 to 2953, 2955 to 3092

Mean of dependent variable = 137.236
Std. dev. of dependent var. = 352.858
Sum of squared residuals = .616690E+08
Variance of residuals = 20638.9
Std. error of regression = 143.662
R-squared = .837073
Adjusted R-squared = .834237
Durbin-Watson statistic = 2.08333
F-statistic (zero slopes) = 295.221
Schwarz Bayes. Info. Crit. = 10.0571
Log of likelihood function = -19394.3

Variable	Estimated Coefficient	Standard Error	t-statistic
C	6.75692	17.6187	.383508
RV209	1.11229	.952001E-02	116.837
DEN	.025166	.352868E-02	7.13171
D02	27.5681	41.0397	.671742
D04	-14.1402	43.5432	-.324739
D05	-2.39629	24.1729	-.099131
D06	34.8571	25.9421	1.34365
D08	9.50655	25.2160	.377004
D09	27.8440	53.7861	.517681
D10	-88.6420	84.7902	-1.04543
D11	-123.504	148.982	-.828983
D12	-6.90239	24.8255	-.278037
D13	-3.20151	20.9544	-.152785
D15	-11.4713	73.9583	-.155105
D16	.603008	27.8990	.021614
D17	-8.42380	22.6075	-.372612
D18	-10.2053	23.0880	-.442015
D19	.972926	22.7314	.042801
D20	1.60863	22.5484	.071341
D21	-2.19939	22.0221	-.099872
D22	10.1965	25.2273	.404185
D23	-4.72706	39.9971	-.118185
D24	-25.4118	34.2713	-.741489
D25	-7.84694	42.4800	-.184721
D26	10.4869	23.9546	.437782
D27	83.1057	23.3580	3.55792
D28	-.818802	23.6709	-.034591
D29	-.122587	22.0901	-.554942E-02

D30	-4.12412	26.3061	-.156774
D31	-15.1508	23.6019	-.641929
D32	10.4505	39.9883	.261338
D33	-8.89360	48.7194	-.182547
D34	-50.7406	36.5766	-1.38724
D35	-5.27900	31.5630	-.167253
D36	1.10325	25.8967	.042602
D37	12.5779	22.6842	.554481
D38	-.080608	26.4372	-.304903E-02
D39	-13.8093	23.3291	-.591937
D40	-2.57907	24.0100	-.107416
D41	19.0992	29.6954	.643169
D42	-10.7174	24.8918	-.430561
D44	-20.8911	66.7043	-.313189
D45	47.9222	27.6965	1.73026
D46	-32.5846	25.0141	-1.30265
D47	-17.1102	22.9581	-.745277
D48	-2.63208	19.7985	-.132944
D49	3.70900	31.9389	.116128
D50	18.1885	42.2277	.430724
D51	-6.64576	23.1395	-.287204
D53	21.8592	29.0319	.752938
D54	-3.17731	26.3069	-.120778
D55	-6.45847	24.4908	-.263710
D56	5.93619	34.7232	.170958

Education Expenditures Per Student

Method of estimation = Instrumental Variable

Instrumental variables: EX202 MEX202 RV201 COLL URBAN DEN HVAL MRV201 MCOLL MURBAN MDEN MHVAL C MINPP82 MUNEMP MHARD MIDLE MPOV MVACANT MRENTP MRVAL MMEDAGE MTEENT MMARRY MDIVOR MBLACK MWHITE MFEMC MHIGH MYOUNG MOLD D02 D04 D05 D06 D08 D09 D10 D11 D12 D13 D15 D16 D17 D18 D19 D20 D21 D22 D23 D24 D25 D26 D27 D28 D29 D30 D31 D32 D33 D34 D35 D36 D37 D38 D39 D40 D41 D42 D44 D45 D46 D47 D48 D49 D50 D51 D53 D54 D55 D56

Dependent variable: EX702
Number of observations: 3087
Current sample: 1 to 532, 535 to 535, 537 to 2348, 2350 to 2652, 2654 to 3092

Mean of dependent variable = 2169.54
Std. dev. of dependent var. = 835.480
Sum of squared residuals = .453493E+09
Variance of residuals = 149767.
Std. error of regression = 386.997
R-squared = .789501
Adjusted R-squared = .785469
Durbin-Watson statistic = 1.92791
F-statistic (zero slopes) = 195.778
E'PZ*E = .631959E+07

Variable	Estimated Coefficient	Standard Error	t-statistic
C	182.892	59.2784	3.08531
EX202	.792482	.014983	52.8917
MEX702	.380726	.086495	4.40170
MEX202	-.408962	.082884	-4.93416
RV201	.141235	.017092	8.26308
COLL	6.37822	1.36528	4.67172
URBAN	-1.63862	.320864	-5.10691
DEN	.058003	.010645	5.44892
HVAL	-.235306E-02	.773854E-03	-3.04070
D02	447.653	117.713	3.80291
D04	435.039	116.350	3.73907
D05	296.625	68.0827	4.35684
D06	423.609	77.8940	5.43828
D08	455.056	80.4262	5.65806
D09	387.269	149.808	2.58511
D10	468.824	229.282	2.04475
D11	-94.3963	402.842	-.234326
D12	350.120	72.2340	4.84702
D13	264.734	60.5873	4.36946
D15	-199.596	394.168	-.506372
D16	76.4412	76.9600	.993259
D17	157.149	61.9200	2.53793
D18	212.154	63.5847	3.33655
D19	124.491	63.1961	1.96991
D20	420.190	71.5565	5.87215
D21	148.208	59.8439	2.47658
D22	-21.0557	69.8004	-.301655
D23	365.958	110.964	3.29801
D24	173.996	95.5440	1.82110
D25	267.077	119.297	2.23876

D26	305.758	68.6559	4.45349
D27	370.017	71.5630	5.17050
D28	111.440	63.9825	1.74173
D29	243.474	61.0581	3.98758
D30	426.478	78.1978	5.45384
D31	194.923	67.5174	2.88701
D32	361.390	108.447	3.33242
D33	357.447	135.009	2.64757
D34	395.516	109.373	3.61622
D35	187.024	85.0308	2.19948
D36	539.219	86.2589	6.25116
D37	284.777	64.8581	4.39077
D38	76.5263	74.5161	1.02698
D39	308.538	66.1406	4.66488
D40	190.289	67.9210	2.80162
D41	312.516	84.4744	3.69953
D42	377.571	73.5951	5.13038
D44	259.913	182.862	1.42136
D45	213.269	75.7649	2.81487
D46	130.608	69.7207	1.87331
D47	40.8904	62.3275	.656057
D48	474.164	67.0292	7.07400
D49	117.163	89.4108	1.31038
D50	361.955	120.382	3.00672
D51	298.802	63.9967	4.66903
D53	269.081	82.6970	3.25382
D54	281.411	73.9746	3.80415
D55	374.972	72.3518	5.18262
D56	892.512	113.162	7.88703

Health and Hospital Expenditures Per Capita

Method of estimation = Instrumental Variable

Instrumental variables: EX203 MEX203 RV201 INPP82 UNEMP DEN MRV201 MINPP82 MUNEMP MDEN C MHARD MIDLE MPOV MVACANT MRENTP MHVAL MRVAL MMEDAGE MTEENT MMARRY MDIVOR MBLACK MWHITE MFEMC MHIGH MCOLL MURBAN MYOUNG MOLD D02 D04 D05 D06 D08 D09 D10 D11 D12 D13 D15 D16 D17 D18 D19 D20 D21 D22 D23 D24 D25 D26 D27 D28 D29 D30 D31 D32 D33 D34 D35 D36 D37 D38 D39 D40 D41 D42 D44 D45 D46 D47 D48 D49 D50 D51 D53 D54 D55 D56

Dependent variable: EX703
Number of observations: 2995
Current sample: 1 to 80, 82 to 304, 306 to 478, 480 to 532, 534 to 534, 537 to 570, 572 to 1004, 1006 to 1016, 1018 to 1019, 1021 to 1039, 1041 to 1041, 1043 to 1044, 1046 to 1047, 1049 to 1051, 1053 to 1060, 1062 to 1080, 1082 to 1085, 1087 to 1087, 1089 to 1089, 1091 to 1116, 1118 to 1140, 1142 to 1179, 1181 to 1184, 1186 to 1188, 1190 to 1190, 1192 to 1567, 1569 to 1640, 1644 to 1645, 1647 to 1647, 1649 to 1666, 1668 to 1671, 1673 to 1673, 1678 to 1680, 1683 to 1685, 1687 to 1689, 1691 to 1695, 1698 to 1706, 1708 to 1717, 1719 to 1719, 1722 to 1723, 1725 to 1727, 1729 to 1729, 1732 to 1789, 1791 to 1796, 1798 to 1807, 1810 to 1889, 1891 to 1962, 1964 to 1987, 1989 to 1989, 1991 to 1994, 1996 to 2012, 2014 to 2132, 2134 to 2139, 2141 to 2327, 2329 to 2348, 2350 to 2396, 2398 to 2400, 2402 to 2517, 2520 to 2561, 2563 to 2570, 2572 to 2588, 2590 to 2604, 2606 to 2619, 2621 to 2623, 2625 to 2636, 2639 to 2643, 2645 to 2646, 2648 to 2652, 2654 to 2668, 2670 to 2674, 2676 to 2681, 2683 to 2691, 2693 to 2698, 2700 to 2703, 2705 to 2746, 2748 to 2768, 2770 to 2770, 2772 to 2776, 2778 to 2803, 2805 to 2812, 2814 to 2821, 2823 to 2830, 2832 to 2843, 2845 to 2863, 2865 to 3092

Mean of dependent variable = 106.662	R-squared = .594240
Std. dev. of dependent var. = 145.408	Adjusted R-squared = .586365
Sum of squared residuals = .257037E+08	Durbin-Watson statistic = 2.01326
Variance of residuals = 8751.67	F-statistic (zero slopes) = 75.3732
Std. error of regression = 93.5504	E'PZ*E = 287513.

Variable	Estimated Coefficient	Standard Error	t-statistic
C	-25.0694	18.7278	-1.33862
EX203	.829138	.015436	53.7139
MEX703	.510623	.185397	2.75421
MEX203	-.429713	.169090	-2.54132
RV201	.010752	.395757E-02	2.71684
INPP82	.272869E-02	.126710E-02	2.15349
UNEMP	1.68686	.800229	2.10798
DEN	.498583E-02	.252885E-02	1.97158
D02	-70.7337	29.8061	-2.37313
D04	-22.4679	27.9058	-.805136
D05	-11.1758	15.9291	-.701595
D06	-21.7322	17.7404	-1.22501
D08	-9.31697	17.2601	-.539797
D09	-36.0503	35.7766	-1.00765
D10	-33.3141	67.4077	-.494218
D11	8.42124	97.3464	.086508

D12	-27.2716	16.3953	-1.66338
D13	10.1279	14.7688	.685762
D15	-27.9899	94.5841	-.295926
D16	-4.49740	18.4764	-.243414
D17	-15.8359	15.2963	-1.03528
D18	-12.5727	15.2936	-.822087
D19	-8.56821	15.1510	-.565522
D20	-10.5723	15.3081	-.690635
D21	8.20674	15.7665	.520516
D22	-16.8566	16.5517	-1.01842
D23	-22.0776	26.5135	-.832694
D24	-38.2021	24.5335	-1.55714
D25	-30.3247	28.3279	-1.07049
D26	-19.6645	16.1814	-1.21525
D27	-29.4105	15.7248	-1.87033
D28	8.21215	15.9564	.514662
D29	-7.62468	14.4752	-.526740
D30	-2.19110	17.7777	-.123250
D31	-11.1682	17.0162	-.656329
D32	69.3253	26.4833	2.61770
D33	-22.8528	32.2742	-.708082
D34	-51.9904	24.6897	-2.10575
D35	-25.2112	21.6265	-1.16576
D36	-19.2699	17.5467	-1.09821
D37	-11.0790	15.1870	-.729506
D38	-24.1899	18.5497	-1.30406
D39	-15.9720	15.6428	-1.02105
D40	-7.70723	16.3794	-.470543
D41	-26.4226	19.9285	-1.32587
D42	-32.1672	17.3110	-1.85820
D44	-36.7638	43.8465	-.838466
D45	-19.8455	18.1002	-1.09642
D46	-13.7188	17.1184	-.801407
D47	-35.2479	15.0857	-2.33650
D48	-7.20820	13.4890	-.534375
D49	-23.0796	22.5988	-1.02127
D50	-21.3512	28.0126	-.762200
D51	-16.7112	15.5662	-1.07356
D53	-10.8097	20.9442	-.516121
D54	-25.5005	17.3328	-1.47123
D55	-41.8523	17.6205	-2.37521
D56	14.8947	24.0131	.620272

Transportation Expenditures Per Capita

Method of estimation = Instrumental Variable

Instrumental variables: EX204 MEX204 RV201 MEDAGE URBAN INPP82 MRV201 MMEDAGE MURBAN MBLACK MWHITE MINPP82 C MUNEMP MHARD MIDLE MPOV MVACANT MRENTP MHVAL MRVAL MTEENT MMARRY MDIVOR MFEMC MHIGH MCOLL MDEN MYOUNG MOLD D02 D04 D05 D06 D08 D09 D10 D11 D12 D13 D15 D16 D17 D18 D19 D20 D21 D22 D23 D24 D25 D26 D27 D28 D29 D30 D31 D32 D33 D34 D35 D36 D37 D38 D39 D40 D41 D42 D44 D45 D46 D47 D48 D49 D50 D51 D53 D54 D55 D56

Dependent variable: EX704
Number of observations: 3082
Current sample: 1 to 1883, 1885 to 1895, 1897 to 2396, 2398 to 2809, 2811 to 2834, 2836 to 2846, 2848 to 2854, 2856 to 2857, 2859 to 2859, 2861 to 2868, 2870 to 3092

Mean of dependent variable = 107.133
Std. dev. of dependent var. = 100.550
Sum of squared residuals = .124821E+08
Variance of residuals = 4127.69
Std. error of regression = 64.2471
R-squared = .599290
Adjusted R-squared = .591737
Durbin-Watson statistic = 2.05602
F-statistic (zero slopes) = 79.3432
E'PZ*E = .102894E+07

Variable	Estimated Coefficient	Standard Error	t-statistic
C	-65.8246	14.2299	-4.62578
EX204	.365066	.014123	25.8484
MEX704	.264193	.051694	5.11072
MEX204	-.113667	.022017	-5.16276
RV201	.036727	.249244E-02	14.7355
MEDAGE	1.45798	.366328	3.97999
URBAN	-.532683	.052972	-10.0560
INPP82	.590580E-02	.817871E-03	7.22095
D02	-91.7344	20.0425	-4.57699
D04	58.0762	18.9544	3.06399
D05	-5.41855	10.8584	-.499018
D06	-1.37709	11.8915	-.115804
D08	55.3982	13.6859	4.04782
D09	-25.7558	24.3890	-1.05604
D10	-38.1302	37.9840	-1.00385
D11	-96.7193	65.4814	-1.47705
D12	-18.0998	11.2897	-1.60321
D13	-13.8638	9.39360	-1.47588
D15	1.27164	33.2559	.038238
D16	8.32205	12.6500	.657869
D17	-10.2844	10.3136	-.997168
D18	-10.6062	10.4215	-1.01773
D19	14.0890	10.9094	1.29145
D20	2.99402	11.2016	.267285
D21	-16.0395	9.88589	-1.62246
D22	-10.7930	11.2775	-.957041
D23	3.47288	17.9264	.193730
D24	-14.9450	15.5087	-.963653
D25	14.1857	19.2073	.738554

D26	12.9693	11.0006	1.17896
D27	36.0671	11.6299	3.10125
D28	-3.47882	10.6317	-.327213
D29	-17.5850	10.0087	-1.75697
D30	-10.1456	11.9167	-.851374
D31	-13.4158	11.1689	-1.20118
D32	-8.26798	17.7002	-.467111
D33	-8.44235	21.9333	-.384910
D34	-31.8417	16.6026	-1.91788
D35	1.74990	13.8488	.126357
D36	14.6098	12.0771	1.20971
D37	-35.8675	10.3861	-3.45340
D38	26.9763	13.1963	2.04423
D39	-5.59467	10.5042	-.532612
D40	.815729	11.0350	.073922
D41	17.7923	13.5221	1.31579
D42	-24.6549	11.2769	-2.18631
D44	-27.8176	29.9421	-.929046
D45	-23.8557	12.4434	-1.91714
D46	16.9973	11.8146	1.43867
D47	.603115	10.2821	.058657
D48	-2.55594	9.13275	-.279865
D49	22.6402	14.5642	1.55451
D50	6.06576	19.0685	.318104
D51	-32.9026	10.4900	-3.13657
D53	19.2025	13.6760	1.40411
D54	-39.7904	11.8486	-3.35825
D55	36.6438	11.9206	3.07399
D56	-42.9562	16.0896	-2.66981

Police Protection Expenditures Per Capita

Method of estimation = Ordinary Least Squares

Dependent variable: EX705
Number of observations: 3089
Current sample: 1 to 80, 82 to 2396, 2398 to 2400, 2402 to 3092

Mean of dependent variable = 53.4687
Std. dev. of dependent var. = 43.4322
Sum of squared residuals = .149037E+07
Variance of residuals = 492.197
Std. error of regression = 22.1855
R-squared = .744145
Adjusted R-squared = .739075
Durbin-Watson statistic = 2.04614
F-statistic (zero slopes) = 146.780
Schwarz Bayes. Info. Crit. = 6.33762
Log of likelihood function = -13926.5

Variable	Estimated Coefficient	Standard Error	t-statistic
C	21.4768	13.4083	1.60175
EX205	.810277	.023222	34.8920
MEX205	.095189	.027258	3.49209
RV201	.010642	.919976E-03	11.5679
YOUNG	-.915383	.259217	-3.53133
OLD	-.401180	.161218	-2.48843
INPP82	.131584E-02	.333552E-03	3.94494
VACANT	.236115	.081792	2.88679
HIGH	-.185157	.082573	-2.24234
DEN	.499670E-02	.669734E-03	7.46073
DIVOR	1.13192	.303745	3.72653
D02	-30.6747	6.89776	-4.44706
D04	14.4993	6.66961	2.17394
D05	-1.44520	3.75388	-.384987
D06	7.52622	4.48109	1.67955
D08	7.71473	4.26252	1.80990
D09	-5.58570	8.43983	-.661826
D10	-14.8517	13.1348	-1.13071
D11	214.201	23.2535	9.21157
D12	26.9357	3.99737	6.73835
D13	-.307785	3.27357	-.094021
D15	12.3327	11.5969	1.06345
D16	3.90663	4.54709	.859149
D17	-5.14340	3.61732	-1.42188
D18	-5.78179	3.67065	-1.57514
D19	-3.03160	3.85546	-.786312
D20	-4.80047	3.83266	-1.25252
D21	6.46897	3.48777	1.85476
D22	5.52140	3.92330	1.40734
D23	2.27261	6.27565	.362131
D24	7.89813	5.36919	1.47101
D25	-7.11892	6.73775	-1.05657
D26	-7.73866	3.84602	-2.01212
D27	.367163	3.96447	.092613
D28	-.660858	3.67800	-.179679
D29	-3.63983	3.51576	-1.03529
D30	-4.36556	4.27669	-1.02078
D31	-8.10210	3.99724	-2.02692
D32	24.3875	6.34184	3.84550

D33	3.31731	7.61488	.435635
D34	-6.86686	5.93679	-1.15666
D35	11.7552	4.90310	2.39750
D36	7.22040	4.17229	1.73056
D37	-2.79182	3.55528	-.785262
D38	-7.07249	4.33758	-1.63052
D39	1.09310	3.69418	.295898
D40	-7.03994	3.80125	-1.85201
D41	-5.54614	4.80717	-1.15372
D42	-5.54437	3.97231	-1.39576
D44	-6.21741	10.3672	-.599717
D45	-2.79998	4.26365	-.656709
D46	-1.22158	4.12695	-.296000
D47	-4.55987	3.59636	-1.26791
D48	5.70517	3.18594	1.79073
D49	10.9869	5.48492	2.00312
D50	-6.46031	6.62187	-.975601
D51	2.54010	3.58676	.708188
D53	-9.94828	4.76377	-2.08832
D54	-6.30485	4.07534	-1.54707
D55	-1.45556	4.10510	-.354575
D56	-3.33808	5.70631	-.584980

Fire Protection Expenditures Per Capita

Method of estimation = Ordinary Least Squares

Dependent variable: EX706
Number of observations: 3067
Current sample: 1 to 257, 259 to 361, 363 to 524, 526 to 552, 554 to 655, 657 to 688, 690 to 1009, 1011 to 1045, 1047 to 1060, 1062 to 1499, 1501 to 1640, 1642 to 1696, 1698 to 1793, 1795 to 2348, 2350 to 2396, 2398 to 2625, 2627 to 2636, 2638 to 2652, 2654 to 2657, 2659 to 2694, 2696 to 2950, 2953 to 2974, 2976 to 2978, 2980 to 3071, 3073 to 3092

Mean of dependent variable =	16.4789
Std. dev. of dependent var. =	17.2222
Sum of squared residuals =	203022.
Variance of residuals =	67.5164
Std. error of regression =	8.21684
R-squared =	.776749
Adjusted R-squared =	.772368
Durbin-Watson statistic =	1.90585
F-statistic (zero slopes) =	177.324
Schwarz Bayes. Info. Crit. =	4.34968
Log of likelihood function =	-10781.3

Variable	Estimated Coefficient	Standard Error	t-statistic
C	-24.9393	2.94724	-8.46193
EX206	.734791	.016417	44.7574
RV201	.166127E-02	.328181E-03	5.06206
BLACK	.180097	.031487	5.71977
WHITE	.168022	.028353	5.92615
INPP82	.692397E-03	.118938E-03	5.82151
VACANT	.095119	.031770	2.99401
COLL	.094943	.026430	3.59224
URBAN	.067209	.785940E-02	8.55139
DEN	.217694E-02	.242381E-03	8.98147
D02	-.965869	2.86095	-.337604
D04	11.1242	2.55037	4.36180
D05	-.101087	1.39868	-.072273
D06	4.56185	1.63968	2.78215
D08	.394960	1.61324	.244824
D09	3.95978	3.14537	1.25892
D10	-6.83113	4.86502	-1.40413
D11	25.1068	8.55919	2.93331
D12	2.56744	1.45682	1.76235
D13	1.00862	1.20090	.839885
D15	15.5683	4.70195	3.31104
D16	-1.24974	1.69785	-.736075
D17	-1.33515	1.37220	-.972999
D18	-1.56098	1.39590	-1.11827
D19	-2.79205	1.39142	-2.00663
D20	-2.19535	1.40084	-1.56717
D21	1.92952	1.32361	1.45777
D22	.040158	1.44272	.027835
D23	2.83679	2.34374	1.21037
D24	.760597	1.99331	.381574
D25	7.80267	2.52432	3.09100
D26	-1.66202	1.43413	-1.15891
D27	-2.64196	1.43633	-1.83939
D28	.241352	1.36830	.176389
D29	-2.00544	1.33282	-1.50466
D30	-2.56074	1.59788	-1.60259
D31	-3.44752	1.43167	-2.40803
D32	.099464	2.35539	.042228
D33	.523369	2.84920	.183690

D34	-6.59814	2.16769	-3.04386
D35	5.62159	1.94643	2.88815
D36	4.21884	1.57015	2.68691
D37	1.71438	1.30570	1.31299
D38	-2.27701	1.61378	-1.41098
D39	2.11097	1.40134	1.50639
D40	-1.15699	1.45994	-.792495
D41	3.28913	1.79376	1.83365
D42	-3.07958	1.49868	-2.05486
D44	6.47346	3.86940	1.67299
D45	-.301540	1.58309	-.190475
D46	-.721762	1.53923	-.468912
D47	1.32965	1.35385	.982131
D48	-1.63328	1.23810	-1.31917
D49	-.877948	1.93074	-.454721
D50	-.212591	2.47732	-.085815
D51	2.41674	1.31258	1.84121
D53	2.18008	1.76879	1.23252
D54	.135051	1.58534	.085187
D55	5.87459	1.47907	3.97182
D56	-4.54278	2.14106	-2.12175

Parks and Recreation Expenditures Per Capita

Method of estimation = Instrumental Variable

Instrumental variables: EX207 MEX207 RV201 INPP82 MRV201 MINPP82 C MUNEMP MHARD MIDLE MPOV MVACANT MRENTP MHVAL MRVAL MMEDAGE MTEENT MMARRY MDIVOR MBLACK MWHITE MFEMC MHIGH MCOLL MURBAN MDEN MYOUNG MOLD D02 D04 D05 D06 D08 D09 D10 D11 D12 D13 D15 D16 D17 D18 D19 D20 D21 D22 D23 D24 D25 D26 D27 D28 D29 D30 D31 D32 D33 D34 D35 D36 D37 D38 D39 D40 D41 D42 D44 D45 D46 D47 D48 D49 D50 D51 D53 D54 D55 D56

Dependent variable: EX707
Number of observations: 3060
Current sample: 1 to 398, 400 to 463, 465 to 470, 472 to 1472, 1474 to 1475, 1477 to 1479, 1481 to 1481, 1483 to 1484, 1486 to 1488, 1490 to 1491, 1493 to 1494, 1496 to 1496, 1498 to 1499, 1501 to 1507, 1509 to 1534, 1537 to 1537, 1539 to 1542, 1544 to 1551, 1555 to 1556, 1559 to 1567, 1569 to 1573, 1575 to 1576, 1578 to 1578, 1580 to 1580, 1582 to 2012, 2014 to 2348, 2350 to 2674, 2676 to 2718, 2720 to 3092

Mean of dependent variable = 25.2679
Std. dev. of dependent var. = 39.0476
Sum of squared residuals = .272399E+07
Variance of residuals = 906.787
Std. error of regression = 30.1129
R-squared = .418786
Adjusted R-squared = .408144
Durbin-Watson statistic = 2.04905
F-statistic (zero slopes) = 38.9011
E'PZ*E = 28151.1

Variable	Estimated Coefficient	Standard Error	t-statistic
C	-12.4358	4.50046	-2.76322
EX207	.663855	.020123	32.9892
MEX707	.422974	.116654	3.62589
MEX207	-.205959	.102064	-2.01793
RV201	.520983E-02	.110724E-02	4.70526
INPP82	.124695E-02	.355419E-03	3.50839
D02	-20.6401	8.80325	-2.34460
D04	31.0967	10.9940	2.82851
D05	.583220	5.06998	.115034
D06	1.80233	6.04693	.298057
D08	7.15555	6.07903	1.17709
D09	-4.28953	11.4278	-.375358
D10	-8.16629	17.8052	-.458647
D11	4.88569	30.6651	.159324
D12	-.121749	5.30423	-.022953
D13	-.474578	4.40156	-.107820
D15	17.6594	15.5739	1.13391
D16	-1.59150	5.89865	-.269807
D17	-2.91870	4.81962	-.605588
D18	-.518008	4.87689	-.106217
D19	-2.62661	4.85218	-.541326
D20	-3.46696	4.98484	-.695501
D21	.068626	4.60835	.014892
D22	4.43623	5.30930	.835557
D23	-1.50253	8.39922	-.178890
D24	2.10479	7.27701	.289239
D25	-5.96929	8.98552	-.664324
D26	-1.01467	4.98975	-.203352
D27	2.70195	5.10508	.529268
D28	-.702099	4.96578	-.141388

D29	-2.28196	4.89102	-.466561
D30	-7.32196	5.64368	-1.29737
D31	-5.52583	5.10220	-1.08303
D32	13.3818	8.28274	1.61562
D33	-.134375	10.2699	-.013084
D34	-8.57745	7.77306	-1.10348
D35	.155117	6.49439	.023885
D36	-2.65470	5.51293	-.481540
D37	-.839410	4.75827	-.176411
D38	7.28732	6.22100	1.17141
D39	-2.87349	4.92734	-.583173
D40	1.26745	5.08968	.249024
D41	2.90837	6.32294	.459971
D42	-3.75941	5.28017	-.711986
D44	-6.38706	14.0256	-.455387
D45	.155972	5.76885	.027037
D46	-.152269	5.30170	-.028721
D47	-.643266	4.80554	-.133859
D48	-2.02240	4.23084	-.478013
D49	14.4773	7.00481	2.06677
D50	-3.35060	8.87854	-.377382
D51	-.583729	4.76407	-.122527
D53	-1.82486	6.30321	-.289512
D54	2.81000	5.48749	.512073
D55	-.215970	5.23516	-.041254
D56	-1.51108	7.62251	-.198239

Welfare and Housing Expenditure Per Capita

Method of estimation = Ordinary Least Squares

Dependent variable: EX708
Number of observations: 2929
Current sample: 1 to 69, 71 to 76, 78 to 79, 82 to 82, 84 to 119, 121 to 124, 126 to 141, 143 to 148, 150 to 150, 152 to 309, 311 to 320, 322 to 430, 432 to 516, 518 to 571, 573 to 874, 876 to 882, 884 to 885, 887 to 888, 892 to 893, 895 to 897, 899 to 899, 901 to 904, 906 to 907, 911 to 913, 916 to 917, 919 to 925, 927 to 936, 938 to 940, 942 to 942, 944 to 945, 947 to 948, 950 to 951, 953 to 955, 957 to 965, 967 to 970, 973 to 976, 978 to 978, 980 to 981, 983 to 989, 991 to 997, 999 to 1003, 1007 to 1010, 1012 to 1015, 1017 to 1021, 1023 to 1027, 1029 to 1030, 1032 to 1032, 1034 to 1043, 1045 to 1060, 1062 to 1062, 1065 to 1067, 1069 to 1070, 1075 to 1078, 1080 to 1081, 1083 to 1086, 1088 to 1089, 1091 to 1096, 1098 to 1122, 1124 to 1153, 1155 to 1182, 1184 to 1416, 1418 to 1430, 1432 to 1468, 1470 to 1472, 1474 to 1475, 1477 to 1486, 1488 to 1488, 1490 to 1495, 1498 to 1500, 1502 to 1506, 1508 to 1509, 1511 to 1518, 1520 to 1528, 1531 to 1536, 1538 to 1543, 1545 to 1567, 1569 to 1570, 1572 to 1575, 1577 to 1579, 1581 to 1620, 1622 to 1622, 1624 to 1640, 1643 to 1669, 1671 to 1675, 1678 to 1694, 1696 to 1696, 1698 to 1729, 1731 to 1780, 1782 to 1784, 1786 to 1788, 1790 to 1792, 1795 to 1796, 1798 to 2122, 2124 to 2138, 2141 to 2155, 2157 to 2184, 2186 to 2197, 2199 to 2312, 2314 to 2396, 2398 to 2470, 2472 to 2518, 2520 to 2524, 2526 to 2556, 2558 to 2570, 2572 to 2588, 2590 to 2604, 2606 to 2607, 2609 to 2619, 2621 to 2632, 2634 to 2651, 2654 to 2668, 2670 to 2674, 2676 to 2697, 2699 to 2760, 2762 to 2764, 2767 to 2767, 2769 to 2771, 2774 to 2776, 2778 to 2781, 2783 to 2910, 2912 to 2923, 2925 to 2938, 2940 to 2949, 2951 to 2951, 2953 to 2953, 2955 to 2958, 2960 to 2964, 2967 to 2974, 2978 to 2978, 2980 to 2981, 2983 to 2985, 2987 to 2989, 2991 to 2994, 2997 to 3073, 3075 to 3078, 3080 to 3084, 3086 to 3086, 3088 to 3092

Mean of dependent variable = 48.8198
Std. dev. of dependent var. = 82.5541
Sum of squared residuals = .576522E+07
Variance of residuals = 2008.09
Std. error of regression = 44.8117
R-squared = .711087
Adjusted R-squared = .705351
Durbin-Watson statistic = 1.84495
F-statistic (zero slopes) = 123.969
Schwarz Bayes. Info. Crit. = 7.74301
Log of likelihood function = -15264.2

Variable	Estimated Coefficient	Standard Error	t-statistic
C	-47.9309	7.92110	-6.05105
EX208	.301898	.010423	28.9649
RV201	.026549	.186904E-02	14.2044
IDLE	.930887	.241842	3.84915
DEN	.020406	.132933E-02	15.3508
RENTP	.539279	.145366	3.70982
VACANT	-.506326	.169554	-2.98623

UNEMP	1.85880	.373944	4.97080
D02	-64.5186	15.0433	-4.28887
D04	.704204	13.2336	.053213
D05	-3.97876	7.70824	-.516170
D06	108.059	8.30147	13.0168
D08	68.2841	8.29276	8.23417
D09	22.0164	16.8220	1.30879
D10	-8.91491	26.4822	-.336638
D11	369.250	46.7577	7.89709
D12	-4.23554	8.04181	-.526690
D13	.059487	6.58591	.903250E-02
D15	38.8240	23.2998	1.66628
D16	2.64312	8.92825	.296040
D17	8.78061	7.11148	1.23471
D18	25.1541	7.35762	3.41878
D19	16.3337	7.21181	2.26485
D20	6.72957	7.74117	.869321
D21	-7.97085	7.22908	-1.10261
D22	-11.0543	7.91876	-1.39597
D23	3.63556	12.5070	.290682
D24	-9.03984	10.9136	-.828310
D25	-.417390	13.2756	-.031440
D26	13.2603	7.70790	1.72035
D27	119.190	7.66561	15.5487
D28	-8.75810	7.42378	-1.17974
D29	1.52607	7.16291	.213052
D30	5.19329	8.41271	.617315
D31	-2.29010	7.62799	-.300223
D32	-9.90333	12.3531	-.801690
D33	47.2547	15.2495	3.09878
D34	28.2718	11.4317	2.47312
D35	5.63000	10.3989	.541403
D36	79.9691	8.41746	9.50039
D37	28.8898	7.14244	4.04481
D38	27.8594	8.46337	3.29176
D39	46.4226	7.37873	6.29140
D40	2.48277	7.72874	.321239
D41	-14.5751	9.45884	-1.54090
D42	26.9840	7.80730	3.45626
D44	2.90237	20.8182	.139415
D45	1.77795	8.67795	.204882
D46	9.64304	7.98123	1.20821
D47	-1.87216	7.18887	-.260425
D48	2.05063	6.43677	.318580
D49	6.09457	11.3380	.537534
D50	-.596859	13.2044	-.045202
D51	27.5715	7.10193	3.88225
D53	-31.6550	9.40008	-3.36753
D54	-7.46084	8.98567	-.830304
D55	60.0946	7.73937	7.76479
D56	-29.8760	12.0778	-2.47363

Sanitation Expenditures Per Capita

Method of estimation = Ordinary Least Squares

Dependent variable: EX709
Number of observations: 3033
Current sample: 1 to 344, 346 to 411, 413 to 537, 539 to 548, 550 to 552, 554 to 576, 578 to 586, 588 to 614, 616 to 644, 646 to 652, 654 to 655, 657 to 665, 667 to 881, 883 to 1004, 1006 to 1392, 1394 to 1640, 1643 to 1673, 1675 to 1689, 1691 to 1695, 1698 to 1735, 1738 to 1789, 1791 to 1796, 1798 to 1987, 1989 to 1992, 1994 to 2001, 2003 to 2011, 2013 to 2014, 2016 to 2348, 2350 to 2350, 2352 to 2355, 2357 to 2360, 2363 to 2364, 2366 to 2371, 2373 to 2374, 2377 to 2377, 2379 to 2382, 2384 to 2387, 2389 to 2395, 2398 to 2399, 2401 to 2406, 2408 to 2518, 2520 to 2524, 2526 to 2588, 2590 to 2604, 2606 to 2623, 2625 to 2632, 2635 to 2652, 2654 to 2674, 2676 to 2681, 2683 to 2698, 2700 to 2760, 2762 to 2951, 2953 to 3092

Mean of dependent variable	= 42.6889
Std. dev. of dependent var.	= 50.0151
Sum of squared residuals	= .513191E+07
Variance of residuals	= 1726.17
Std. error of regression	= 41.5472
R-squared	= .323377
Adjusted R-squared	= .309949
Durbin-Watson statistic	= 1.92733
F-statistic (zero slopes)	= 24.0827
Schwarz Bayes. Info. Crit.	= 7.59228
Log of likelihood function	= -15576.8

Variable	Estimated Coefficient	Standard Error	t-statistic
C	-96.8230	16.7043	-5.79628
EX209	.170138	.017309	9.82974
RV201	.015304	.165634E-02	9.23968
RENTP	.588644	.159671	3.68661
COLL	.518574	.153077	3.38766
URBAN	.084798	.035260	2.40496
BLACK	.600922	.166886	3.60079
WHITE	.648347	.153462	4.22481
DEN	.568561E-02	.118020E-02	4.81749
HVAL	.442656E-03	.865532E-04	5.11427
D02	36.6434	13.6923	2.67621
D04	21.5270	12.9297	1.66492
D05	6.03908	7.08583	.852276
D06	-15.5501	8.69323	-1.78876
D08	28.5096	8.09500	3.52188
D09	-6.10137	15.8516	-.384905
D10	23.7367	24.5622	.966392
D11	-41.6043	43.2658	-.961597
D12	5.17569	7.30977	.708051
D13	5.75688	6.09486	.944546
D15	19.3945	24.6513	.786754
D16	2.27009	8.73755	.259808
D17	6.41591	6.93842	.924693
D18	2.39472	7.01540	.341352
D19	11.0700	6.99187	1.58327
D20	-12.9711	7.03741	-1.84317
D21	3.47694	6.74492	.515491

D22	13.7412	7.29346	1.88404
D23	29.6852	11.8149	2.51252
D24	14.3101	10.0966	1.41732
D25	26.2119	12.5897	2.08201
D26	5.75697	7.21442	.797981
D27	-1.53737	7.29108	-.210857
D28	-5.60011	6.93647	-.807343
D29	6.62860	6.72594	.985527
D30	-5.35352	8.08874	-.661848
D31	-20.2677	7.30862	-2.77312
D32	3.78921	12.3439	.306970
D33	4.57737	14.3407	.319186
D34	38.6201	10.8189	3.56970
D35	12.5018	9.88415	1.26483
D36	16.3334	7.90917	2.06513
D37	-8.41961	6.60983	-1.27380
D38	-12.4563	8.37804	-1.48677
D39	9.65629	7.08890	1.36217
D40	3.70031	7.34444	.503825
D41	-18.6562	9.10043	-2.05003
D42	12.1225	7.51113	1.61394
D44	-13.8223	19.4883	-.709263
D45	12.8080	8.01180	1.59865
D46	-7.91145	8.26264	-.957497
D47	5.57295	6.86494	.811798
D48	9.52611	6.12255	1.55591
D49	-3.58494	9.85994	-.363586
D50	2.66338	12.5247	.212651
D51	9.11193	6.60963	1.37858
D53	2.14578	8.93662	.240111
D54	5.71512	7.94563	.719279
D55	12.2541	7.48944	1.63618
D56	-21.3693	10.7369	-1.99026

Finance and Administration Expenditures Per Capita

Method of estimation = Ordinary Least Squares

Dependent variable: EX710
Number of observations: 3092
Current sample: 1 to 3092

Mean of dependent variable = 175.558
Std. dev. of dependent var. = 199.268
Sum of squared residuals = .757322E+08
Variance of residuals = 24936.5
Std. error of regression = 157.913
R-squared = .382971
Adjusted R-squared = .372000
Durbin-Watson statistic = 2.03940
F-statistic (zero slopes) = 34.9069
Schwarz Bayes. Info. Crit. = 10.2491
Log of likelihood function = -20011.5

Variable	Estimated Coefficient	Standard Error	t-statistic
C	-93.0630	23.4898	-3.96184
EX210	.539226	.022506	23.9588
RV201	.058684	.618110E-02	9.49411
INPP82	.011140	.192444E-02	5.78892
URBAN	-.339654	.114857	-2.95719
D02	-6.62366	46.5707	-.142228
D04	115.816	46.5005	2.49065
D05	16.0151	26.6010	.602046
D06	6.75253	29.1710	.231481
D08	97.8003	28.5844	3.42145
D09	16.9098	59.9461	.282083
D10	3.93263	93.3504	.042128
D11	219.941	160.784	1.36793
D12	105.330	27.4211	3.84120
D13	48.8358	23.0901	2.11501
D15	96.4385	81.4729	1.18369
D16	36.5612	30.7593	1.18862
D17	10.9166	25.3136	.431253
D18	41.7447	25.6277	1.62889
D19	-19.1062	25.4792	-.749874
D20	44.2700	25.6741	1.72430
D21	49.0668	24.2249	2.02547
D22	59.8725	27.6852	2.16262
D23	21.6478	44.0574	.491353
D24	20.6896	38.1112	.542875
D25	37.0221	47.0951	.786114
D26	21.8221	26.2051	.832742
D27	1.04296	26.1804	.039837
D28	51.3996	26.0933	1.96984
D29	1.81323	24.4603	.074129
D30	74.6212	28.9657	2.57620
D31	-18.3239	26.1983	-.699431
D32	90.5895	43.4516	2.08484
D33	-18.4002	53.8670	-.341586
D34	85.1740	40.7182	2.09179
D35	103.913	34.0060	3.05573
D36	38.8766	28.9011	1.34516
D37	17.6274	25.0549	.703552
D38	-3.17573	29.5615	-.107428

D39	-2.87495	25.8211	-.111341
D40	-43.8026	26.7070	-1.64012
D41	-9.73991	32.9423	-.295666
D42	35.9015	27.6608	1.29792
D44	1.77102	73.5782	.024070
D45	40.7063	30.2726	1.34466
D46	-3.08974	27.6393	-.111788
D47	23.1755	25.2613	.917431
D48	63.0534	22.1647	2.84476
D49	120.780	35.1599	3.43517
D50	-7.63694	46.6732	-.163626
D51	16.4717	25.1207	.655702
D53	-14.7646	32.4685	-.454736
D54	57.0139	28.8466	1.97645
D55	-1.16297	27.2169	-.042730
D56	90.8173	39.2913	2.31139

Utility Expenditures Per Capita

Method of estimation = Ordinary Least Squares

Dependent variable: EX711
Number of observations: 3052
Current sample: 1 to 69, 71 to 80, 82 to 174, 176 to 477, 479 to 548, 550 to 958, 960 to 974, 976 to 1016, 1018 to 1078, 1080 to 1282, 1284 to 1621, 1623 to 1640, 1643 to 1689, 1691 to 1695, 1698 to 1743, 1745 to 1780, 1782 to 1804, 1806 to 2313, 2315 to 2348, 2350 to 2525, 2527 to 2588, 2590 to 2632, 2634 to 2636, 2638 to 2652, 2654 to 2698, 2700 to 2802, 2804 to 2807, 2809 to 2809, 2811 to 2821, 2823 to 2823, 2825 to 2829, 2831 to 2837, 2839 to 2846, 2849 to 2855, 2857 to 2859, 2861 to 2862, 2864 to 2868, 2870 to 3092

Mean of dependent variable	= 151.164
Std. dev. of dependent var.	= 410.937
Sum of squared residuals	= .176354E+09
Variance of residuals	= 58823.8
Std. error of regression	= 242.536
R-squared	= .657713
Adjusted R-squared	= .651661
Durbin-Watson statistic	= 2.06371
F-statistic (zero slopes)	= 108.693
Schwarz Bayes. Info. Crit.	= 11.1064
Log of likelihood function	= -21062.4

Variable	Estimated Coefficient	Standard Error	t-statistic
C	-77.4189	31.5487	-2.45395
EX211	.505426	.011032	45.8141
RV201	.176271	.011174	15.7755
URBAN	.430330	.163690	2.62894
D02	-423.998	73.6467	-5.75719
D04	-107.676	71.4756	-1.50648
D05	-25.8252	40.8104	-.632809
D06	-126.054	44.6126	-2.82554
D08	-120.503	43.3880	-2.77734
D09	-48.0235	90.8237	-.528755
D10	-65.0450	143.138	-.454420
D11	-116.394	247.261	-.470731
D12	-28.0948	41.9960	-.668989
D13	-23.4201	35.3811	-.661936
D15	.904615	124.925	.724124E-02
D16	-83.5685	47.4464	-1.76132
D17	-74.3779	38.1970	-1.94722
D18	-60.7538	38.9780	-1.55867
D19	-109.674	38.6335	-2.83882
D20	-103.748	38.5749	-2.68952
D21	1.73715	37.2288	.046661
D22	-81.9943	42.5086	-1.92889
D23	-63.3494	67.4992	-.938520
D24	-95.5695	57.7418	-1.65512
D25	-34.4791	71.5190	-.482097
D26	-97.3125	40.2171	-2.41968
D27	68.3422	40.1959	1.70023
D28	-49.3745	39.9970	-1.23446
D29	-21.0523	37.3107	-.564244
D30	-165.106	44.6605	-3.69691
D31	-19.8536	39.8380	-.498357

D32	-153.998	67.8848	-2.26852
D33	-64.6846	82.2396	-.786539
D34	-159.677	61.1968	-2.60923
D35	-92.3511	53.4385	-1.72818
D36	-190.800	44.4958	-4.28806
D37	19.8229	38.3400	.517028
D38	-120.531	44.9544	-2.68118
D39	-79.3332	39.3681	-2.01517
D40	-74.1200	40.5889	-1.82612
D41	-122.926	50.6054	-2.42912
D42	-62.1848	41.9215	-1.48336
D44	-59.0900	112.686	-.524377
D45	76.5639	46.7516	1.63767
D46	-95.9200	42.3943	-2.26257
D47	55.5253	38.7513	1.43286
D48	-68.8665	33.5056	-2.05537
D49	-69.1662	54.0861	-1.27882
D50	-.788422	71.3245	-.011054
D51	-39.4672	38.9684	-1.01280
D53	-71.2441	49.4043	-1.44206
D54	-54.5573	44.2208	-1.23375
D55	-109.667	41.5618	-2.63864
D56	-231.185	60.9039	-3.79591

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13. ABSTRACT *(Maximum 200 words)*

This report documents the development and implementation of a model to estimate the effects on local public revenue and expenditures which would be expected to stem from the construction and operation of an infrastructure facility (such as a lock and dam or a highway). To accomplish this purpose reliably, and to be of the most use to the relevant audience of local decisionmakers, the model was specified to have certain characteristics.

This report summarizes the LPFI Model, its general characteristics, and its use. The report includes specific user instructions for the access and use of the FIFS/LPFI model combination. Four hypothetical case studies are provided. The traditional or conventional methods of computing fiscal (i.e., revenue and expenditure) impacts by planners are reviewed, and several available, competing fiscal impact models are discussed and evaluated. Finally, the report provides technical documentation concerning the LPFI model's logic, econometric structure, statistical estimation methodology, and performance evaluation.

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